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ABSTRACT

This book introduces third through sixth grade teachers to problem-based learning (PBL), a system for classroom instruction and curriculum development. It combines the PBL system with practice in locating, evaluating, and thinking about information from the Internet. It provides 8 PBL units for use in the classroom, offering instructions for completing each unit in 14 class periods. In each unit, teachers and students use four types of materials: the coaching plans, rubrics, the problem logs, and the PBL units. Each unit presents a problem to be solved by students working in large and small groups and independently. The units contain scenarios describing a problem just as it might occur in real life. Students investigate elements in each problem, searching for pertinent information on the Internet, and in the process developing their critical thinking skills, learning to identify relevant and reliable data, and applying it to produce realistic solutions. The book includes reproducible problem solving worksheets, teaching notes showing how to differentiate the material, plans to create new PBL units based on the model, and information about using the Internet as an instructional tool. Three appendixes present basic procedures for searching the Web, using information from the Web, and using the Internet responsibly. (SM)

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Problem-Based Learning with the Internet

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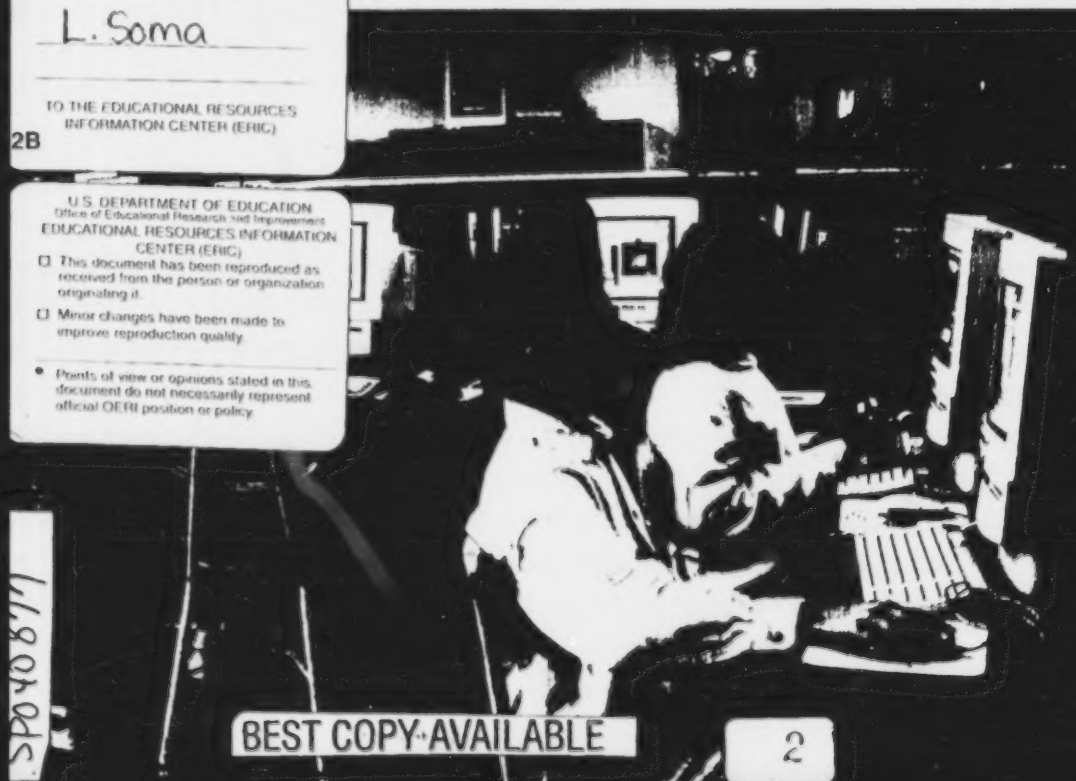

Grades 3–6

William J. Stepien

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Grades 3–6

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WILLIAM J. STEPIEN

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Preface

When my first book, *The Internet and Problem-Based Learning* (2000), was published by Zephyr Press, there were few books on how to use the Internet for solving real-world, curriculum-related problems. I'm happy to report that the number of resources is increasing; but still, not enough material is being produced to help teachers—already burdened by wildly expanding demands on their time—to implement what educational theory prescribes. I hope this book, with activities that can go directly into the classroom, will help open the door to using Problem-Based Learning and the World Wide Web in the elementary school classroom.

Many people share in the development of a book. In my case, special thanks are due to Jenny Flynn at Zephyr Press, who knows every button to push; and to Shelagh Gallagher, my friend, colleague, and wife, who helps shape everything I do. Many of the ideas on these pages come from her wonderful blend of imagination and deep understanding of how kids learn. Kathy Coates captured the essence of each problem in her wonderful illustrations and created children whom I would expect to see walking the halls of any school in the nation. Chris Weiss had ten ideas for every question I asked. She used her classroom experience to keep me honest and her creativity to extend my reach. Ricky Bourque edited the manuscript with compassion for the eventual readers and savvy advice for the author. Thank you, everyone.

Bernard Hollister died, not unexpectedly, during the writing of this book. He had been fighting cancer for some time. This project was a special opportunity for us: a time when two friends—a master and his apprentice, an inspiration and the inspired—could say "goodbye." Bernie endured my endless talking about the book during his last months because he knew I couldn't just hold his hand and share his journey. Thanks, Bernie. Don't be surprised if I send a few more questions your way now and then.

Please use this book to help children enjoy and learn from ill-structured problems and the captivating, although somewhat overwhelming, world of the Internet.

What You Should Know about This Book

This is a teacher's book. Its purpose is twofold:

1. To introduce to teachers Problem-Based Learning (PBL), a system for classroom instruction and curriculum development
2. To combine the Problem-Based Learning system with practice in locating, evaluating, and thinking about information from the Internet

Eight problem-based units are provided for direct use in the classroom. Instructions are given for completing each unit in 14 class periods, although the units work best when adjusted to fit the needs of individual teachers and their students.

The subject matter in these units is anchored to traditional course content. Teachers who use this system do not stray from recognizable subject matter, but they do switch to a strategy that simultaneously merges traditional course content with a teaching method that develops problem-solving skills and Internet use.

Target Audience

Problem-based units 1 through 4 are designed for use with students in grades three and four, and units 5 through 8 are created for use with fifth and sixth graders. However, the units can be adapted for use with children in all four grades. The subject matter can be made more complex for students in gifted programs, or it can be presented in a more concrete fashion in special education settings.

Contents and Materials

In each unit, teachers and students will use four distinct types of materials:

1. **The Coaching Plans.** See pages 19–44.

   These lesson plans provide a suggested sequence of instruction that leads teachers ("coaches") through 14 classroom sessions that feature the PBL process.

2. **Rubrics** (standards of performance). See pages 45–55.

   A master set of rubrics provides five performance standards that can be applied to each student's work. Students can use these rubrics to set goals and self-assess their progress; teachers can use them to assess students' performance as recorded on the Problem Logs.

3. **The Problem Logs** (reproducible information sheets, worksheets, and assessment tools). See pages 57–89.

   Seven problem logs provide structure to the PBL process in this book. Gradually and sequentially, the logs lead students through the four stages of a PBL unit, from *engagement* in the problem, through *investigation* and the process of *building solutions*, and culminating in *debriefing* and analysis of their performance on each unit.

4. **The Problem-Based Learning (PBL) Units** (problem scenarios and additional information for the teacher). See pages 91–122.

   Each of the eight units presents a problem to be solved by the students, who work in large and small groups and independently. Each unit contains a scenario in which a problem is described just as it might occur in real life, and special information pertaining to that unit is presented in an overview for the teacher.

Unique Features of This Book

Merging the Internet with the PBL Process

Students investigate elements in each problem, searching for pertinent information on the Internet. In the process, they develop their critical-thinking skills, learn to identify relevant and reliable data, and apply it to produce realistic solutions to the problem.

Familiarity with the Computer

The material in this book is designed to be equally beneficial to teachers who are comfortable with computers and the Internet, and to novice users. If you are among the latter, you will find that practicing Web searches before doing them with your children will make you more comfortable with the technology than trying them the first time when the children are present.

This subject is discussed in more detail in Fusing the Internet with Problem-Based Learning (page 13) and in the appendixes (page 129).

Interdisciplinary Qualities

Curricular objectives are listed for each unit, but each unit also provides an opportunity to emphasize the interdisciplinary qualities of problems in the real world. You can choose how the unit is to be used, and either emphasize its discipline-specific content or open it to stimulate inquiry across the disciplines.

Differentiation

At various points throughout this book, general methods are described for differentiating instruction, or modifying the unit to match the skills and needs of individual learners. Specific suggestions also are provided for differentiation (page 20). By utilizing various grouping patterns and using the three "pathways" provided for many Problem Logs, you can present activities that range from concrete and structured, to abstract and open.

Assessing Students' Performance

The seven Problem Logs can be used not only for instruction, but also for judging each student's performance. Five performance standards are described in rubrics (page 48). Applying these standards to each student's work on the Problem Logs will give you a clear and accurate picture of how the student is performing. It also will highlight areas in which the student needs acceleration or review.

Suggestions for using the Problem Logs and rubrics for judging students' work are provided in the Coaching Plans (page 19) and starting on page 45.

I urge you to set aside customary tests and quizzes while using these Problem-Based Learning units, and use this method of authentic assessment in their place.

Part I

Problem-Based Learning

The Nature of Problem-Based Learning

There is tremendous pressure today for schools to "cover" increasingly larger quantities of information. Part of that pressure comes from being involved in the high-stakes game of state and national accountability. Regardless of the reasons, too often the pressure results in an "iceberg curriculum."

Imagine an ocean filled with icebergs. The ocean is the time we have to help students develop deeper understanding of the content that makes up our curriculum. An iceberg is a theme, topic, or skill that occupies space in the ocean. In many of our schools, courses are overflowing with icebergs, leaving little time to teach more than the tip of each one. This superficial coverage of substance is not conducive to developing higher-order thinkers and expert problem solvers.

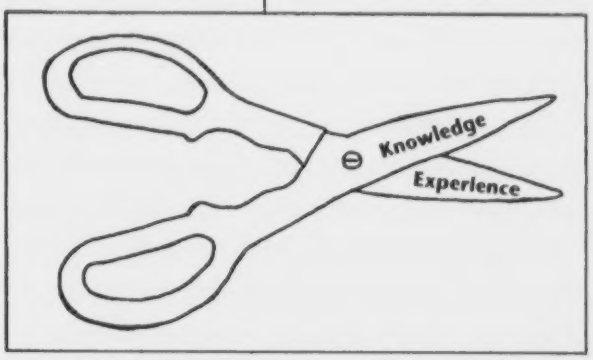
The process of Problem-Based Learning (PBL) counterbalances the race for coverage. The PBL process starts at the tip of an iceberg and takes students on a deep dive to its core. It promotes explorations to neighboring icebergs for information that relates to the problem under investigation, and it engages students in complex ideas and experiences.

Problem Solving in the Classroom

No one gets better at problem solving by merely growing older. Teachers have an interest in helping their students become better problem solvers; but in many classrooms, attention to this worthy goal involves showing students how to resolve simple problems by applying simple formulas. Seldom are complex problems presented as the primary focus of a unit—problems that present opportunities for students to learn and refine problem-solving skills. Moreover, learning someone else's formula is too often considered the same as becoming a better problem solver.

Characteristics of Expert Problem Solvers

Imagine that a special pair of scissors has been placed in children's hands so they can "cut through" problems and resolve them. The blades of the scissors represent the characteristics of expert problem solvers. One blade represents the knowledge base needed to understand a complex problem. Without reliable, relevant knowledge and an understanding of how that knowledge can be upgraded, supplemented, and applied to the problem, the problem solver is powerless.



A tool for resolving ill-structured problems

But knowledge accounts for only one blade of the scissors. The second blade is experience. Without experience in using the knowledge and reasoning necessary to resolve ill-structured problems, the knowledge bases lose their value and become inert, and the attributes of critical thinking never flower.

Using Problems That Teach

The instructional materials in this book offer opportunities for students to:

1. Increase their knowledge base through investigation and research
2. Experience the process of using knowledge and reason to solve problems found in real-world situations

In the eight Problem-Based Learning units presented in this book (page 91), students encounter significant subject content that leads them to a deeper understanding of the issues in each problem. Along the way, students strengthen their critical thinking skills, experience the entire process of inquiry, and become better problem solvers.

Ill-Structured Problems

Instruction changes during Problem-Based Learning. At the opening of each PBL unit, students encounter a situation that has an ill-structured problem at its core. The ill-structured problem provides an authentic context for learning and engages students through its challenge, missing details, and open-endedness.

Terms routinely used in Problem-Based Learning are defined in the glossary beginning on page 142.

Ill-structured problems provide an excellent learning environment because they:

- Are complex and cannot be fully understood when first encountered
- Often change in nature as more is discovered about them
- Defy solution by simple formulas
- Require careful consideration of the fit between solution and problem
- Illustrate the difficulty of being sure one has "the right answer" because data can be missing or in conflict even after exhaustive investigation

An ill-structured problem demands that students approach problem solving the way we find it in life. It requires students to:

- Identify issues
- Create hypotheses
- Conduct investigations
- Develop acceptable solutions
- Justify the solutions to others

While doing this, students crisscross domains of knowledge and make interdisciplinary connections. They move forward, hit dead ends, revisit ideas, revise their thinking, and move on. In the process, they build substantial knowledge bases, enter into real collaborations with classmates, and strengthen their problem-solving skills.

Coaching Students to Be Better Problem Solvers

Imagine a school gym at the opening of a new basketball season. The players enter the gym and the coach sends them to the bleachers with their notepads and pencils. For the rest of the practice sessions, the coach lectures on the fine points of the game, shows videos of great players, demonstrates skills, and quizzes the players on a few of the many plays they will be using during the basketball season.

How do you think the team will perform in games when the season opens? Unless the other teams are coached just like theirs, they will get beaten—and beaten badly! Why? The players are never invited down from the bleachers to practice their skills, try out the plays, and learn to work as a team. They have been told about the game, but their performance will not improve until the coach fades to the sidelines and gives them the ball.

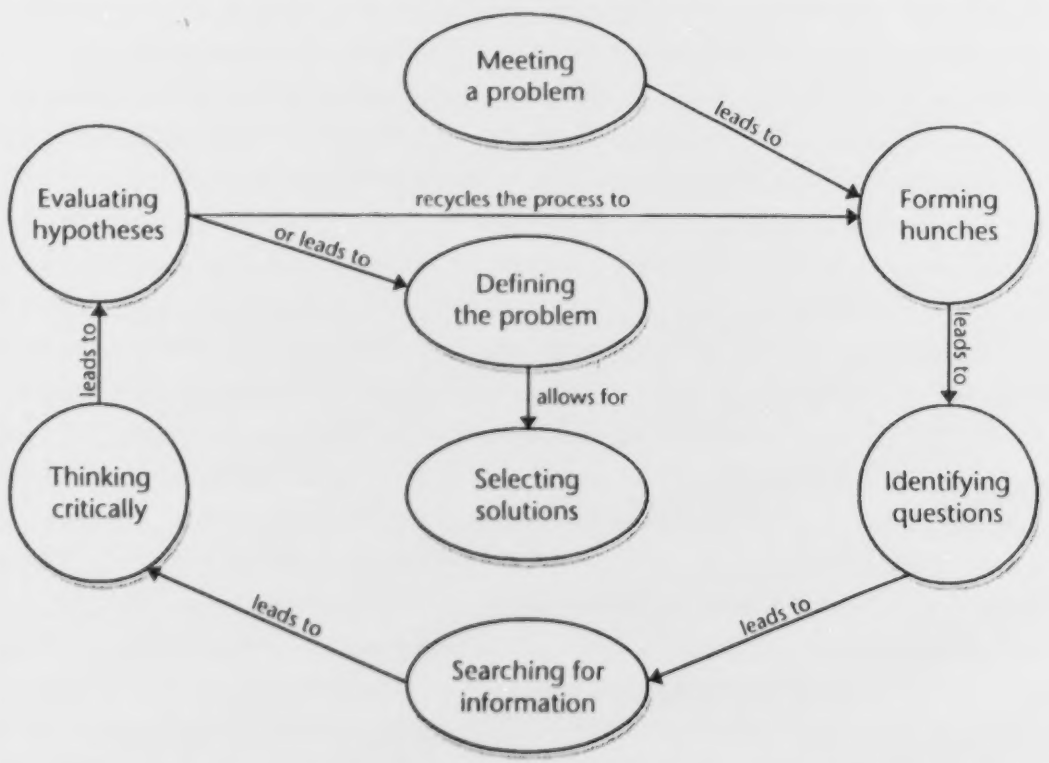
This metaphor can be applied directly to helping students become better problem solvers. Students will improve little if they "stay in the bleachers." To become skillful, they themselves must construct the knowledge base necessary to understand complex ideas and apply that knowledge to real problems.

In Problem-Based Learning, teachers are required to abandon some traditional "teacher" behavior and instead take the role of cognitive coaches who insist students practice problem-solving skills. As they wrestle with problems, students search out information and knowledge to be used as tools with a distinctive purpose—to help them solve those problems. Teachers serve them well when they allow the students to become real problem solvers and not remain simply spectators to the process. But when teachers see that it's necessary to help with complex ideas or difficult skills, they step into the activity to question, clarify, demonstrate, and embed traditional instruction into the PBL unit at the time it is needed.

The Process of Reflective Inquiry

In every problem area or domain, expert problem solvers borrow heavily from the reasoning process commonly called *reflective inquiry*. The principal components of the inquiry process are illustrated in The Circular Flow of Inquiry during Problem Solving.

Circular Flow of Inquiry during Problem Solving



An interesting characteristic of this process is that human brains take to it so easily. Given an awareness of something that is puzzling, the brain is likely to begin speculating about it, forming hunches and conclusions that are largely intuitive and usually unexamined. Then comes "the branch in the road." Novice problem solvers usually stay on the road of uncritical, undisciplined thought. Expert problem solvers veer off onto a road of reflective inquiry.

The components of the inquiry process illustrated in the diagram appear to be distinctive, isolated stops along the road to problem resolution. In reality, they are more like periods of specialized focus during the broad flow of brain activity initiated by an alluring pursuit. Hunches (eventually becoming *hypotheses*) about the nature of a problem foreshadow the questions that will guide the search for new information. Through the process of critical thinking, new information becomes the raw material from which new knowledge about important issues and concepts is constructed. Armed with this new and trusted knowledge, original hunches and hypotheses are examined and the problem solver is better able to recognize which should be pursued and which should be abandoned or modified.

The value of an ill-structured problem as the core of a PBL unit is implicit, if not explicit, in the diagram. What engages the brain's interest in the hunt? At the top of the circle is an unresolved question, an intriguing situation, or a beckoning opportunity about which little is known. It needs to be investigated before it will reveal its true nature and can be satisfactorily defined and then resolved or fulfilled, usually by a choice from competing products or solutions.

The characteristics of ill-structured problems are listed on pages 6–7.

Reflective Inquiry in Problem-Based Learning

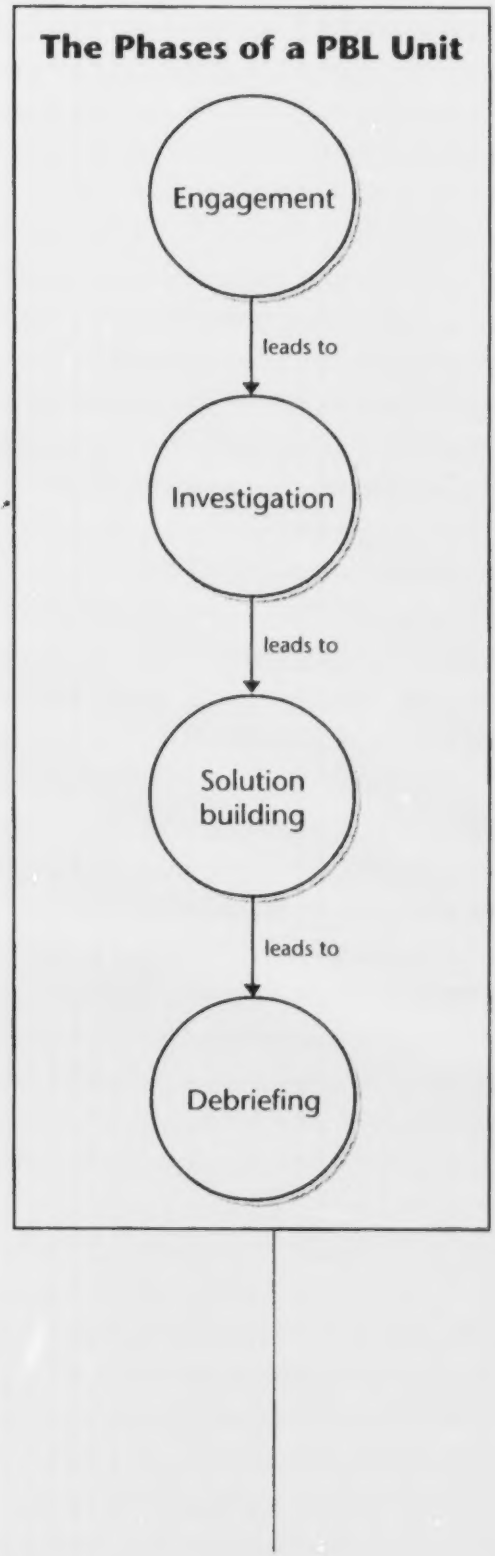
Reflective inquiry is featured throughout PBL units. This usually is accomplished by organizing units around four phases—engagement, investigation, solution building, and debriefing—as shown in The Phases of a PBL Unit on the next page.

Phase 1: Engagement

During the first phase of a PBL unit, students are engaged in the problem. The teacher's responsibilities, as the students' cognitive coach, are to:

- Introduce students to Problem-Based Learning and explain their responsibilities as stakeholders in the problem. Because they are stakeholders, each student is responsible for solving the problem.

Stakeholder:
A person who has a share or interest in an activity or venture. In the PBL context, someone who is called to take action; the problem solver



- Present the problem through a scenario or situation modeled after real life
- Facilitate an action plan for investigating the problem

The action plan takes the form of a large, four-columned chart that is assembled on the chalkboard. (See page 28 for an illustration of a PBL Action Plan chart.) The columns of the chart are filled in as the students discuss the opening scenario, identify facts (listed in column 1) and hunches (listed in column 2), pose carefully constructed questions (listed in column 3), and list possible resources (column 4). Based on their chart, the students plan the investigations that will answer their questions.

Phase 2: Investigation

During this phase, students find and collect information, using the list of questions identified during engagement and recorded on the action plan. They visit sources, determine the relevance and reliability of the information they find, and organize it to help them think about the concepts and issues in the problem. The coach delivers some embedded (direct) instruction during the investigation phase to help students with especially complex ideas and skills.

This phase usually ends with the students building a problem definition. Defining a problem in the PBL sense means more than coming up with a question that needs an answer. In PBL, a definition has two important components:

1. It identifies the central concern or question that needs to be resolved.
2. It identifies criteria (conditions and details) that will separate acceptable solutions from all others. Because ill-structured problems usually can be resolved in more than one way, criteria must be used to help decide which are the most fitting choices from the range of possibilities.

The coach's responsibilities during investigation are to:

- Monitor the difficulty of the task, making sure the students stay motivated and challenged
- Use questioning strategies that focus on critical thinking and metacognition (thinking about thinking)
- Model sound critical thinking and metacognition
- Challenge sloppy thinking
- Provide embedded instruction, focusing the instruction on what students need, but avoiding the temptation to talk them through the problem

Embedded Instruction: Short periods of direct instruction, delivered as needed during investigations, to assist learners with new or especially difficult concepts or skills

Phase 3: Solution Building

As the students build significant new knowledge about the problem and define what they face, it becomes time to brainstorm the range of solutions that can help resolve the problem. Using criteria for a fitting solution, students narrow the possibilities to the most reasonable ones and consider the consequences, positive and negative, that may occur from each. Ethical implications of various solutions are considered if they are significant. Each student then must choose "the best solution" and justify his or her choice.

To culminate the solution-building phase, each student assembles a product to communicate his or her solution. These solution products are discussed generally in The Coaching Plans (page 22) and specifically in the overview to each of the eight units, starting on page 91.

The coach's responsibilities during solution building are to:

- Probe the connections between the evidence and various problem definitions
- Challenge inconsistencies between conclusions and evidence
- Encourage creative responses to identified problems
- Be sure the consequences of alternative solutions are identified
- Ask students to think about the ethical implications of the actions they propose
- Be sure every student is progressing through the unit

Phase 4: Debriefing

The final phase of a PBL unit calls for debriefing student performance. After the students submit their solutions, time is spent retracing strategies and extending insights to new situations. Concepts and skills are reviewed and, if necessary, taught again.

Debriefing is especially important for developing metacognitive insights regarding the effectiveness of problem-solving strategies. The new insights then can be used to improve performance in the next problem-solving situation.

The coach's responsibilities during debriefing are to:

- Call attention to important events that took place during the unit and help the students examine those events in order to recognize their significance
- Consider general behavior that helped or hindered group performance
- Revisit solutions under "What if . . .?" circumstances. Changing a condition in the original problem will help students to reflect on the nature of their solutions and rationales for their acceptance.
- Have students consider the transfer of solutions or important concepts to contemporary situations with similar conditions
- Explore metacognitive issues related to performance so students can plan improvements

A Final Word

Much of the thought that goes into crafting PBL units is concentrated on making sure students are likely to reach significant content objectives. An equal amount of thought and commitment must be given to coaching each problem well so that the experience of practicing new skills and learning new responsibilities is as productive as possible.

Fusing the Internet with Problem-Based Learning

The critical-thinking skills required in Problem-Based Learning are like those needed to solve problems presented in traditional printed materials. However, the problem-solving process changes when students become engaged in locating and evaluating information presented on the World Wide Web. The very nature of the Internet, with its vast array of sites and unedited collections of information, makes it more important than ever for students to develop the ability to access and recognize relevant and reliable data.

When students use the Internet in conjunction with the activities presented in this book, they will be searching for information of various types. The information may be in the form of interactive exhibits or pictures, maps, music, or speech. It may be an online version of something they already have experienced, such as a dictionary or encyclopedia. The good news is that most of the information they will be looking for is out there. The bad news is that it is sometimes hard to find simply because there is so much information on the Internet.

When the bulk of information available to the public for problem solving was found in books, newspapers, or journals, it was reasonable to assume that some level of integrity was associated with its publication. Today, the openness of the Internet means that anyone can present anything and wrap it in a cloak that makes it appear to be the product of rigorous, unprejudiced investigation. This open structure puts a special burden on schools to be sure children learn how to work responsibly with electronically stored information.

Internet and World Wide Web: The World Wide Web is one part of the Internet, the part most of us use for research. Practically speaking, however, the terms are often used interchangeably.

Preparing Yourself

Before beginning any of the PBL units presented in this book, it is important to perform the same information search that the students will be doing. Most schools have a person in charge of the computer laboratory who will help you. Check the availability of the websites listed in the students' material. If you find that a site seems poorly

matched to your students, substitute another site. Also, it is mandatory to confirm websites because sites are frequently changed or removed from the web. If a site has moved or closed down since it was selected for this book, doing the search ahead of time will give you the opportunity to make appropriate adjustments.

Starting the Computer

Go through the basic process before introducing your students to the computer. Become familiar with the steps they will go through, noting the sounds, graphics, and time segments they will encounter.

Determine the state of readiness the computers will be in when the students first meet them. Be prepared to show them where the power switch is located and explain what the machine is doing as it goes through its start-up process.

Be sure you have the answers to these questions before students begin the project:

- Will the students meet a screen of small icons and have to make selections to use a search engine?
- Will they need to type their names into a box or enter a password?
- Will the search engine be pre-selected, or will they choose from a menu?
- How long should they be prepared to wait for the computer to take them to their choice after they have clicked on an icon?

Saving Material

Learn, and then teach the students, how to save and later access important Internet material. At some schools, students save information on the computer's hard drive. At other schools, they save material on floppy disks or other storage media. Find out whether each computer accepts a floppy disk, and arrange to get one for each student or work group.

Preparing Your Students

Test your students' basic computer competencies before beginning the problems in this book. For beginning users, demonstrate and teach basic computer skills. Pair these students with computer-savvy classmates. If a significant number of students require instruction or review, schedule a session in the computer lab.

Be sure all students:

- Know how to use the mouse and are able to distinguish between clicking (which highlights an item) and double-clicking (which causes an action)

- Understand the terms *icon, files, bookmarks, links,* and *menu*

Once the students demonstrate basic computer competencies, they are ready to tackle the Internet. As they navigate on the web, they will need to have a variety of other computer skills. The information in appendix 1 is offered to help you be sure they become computer-literate investigators.

For definitions of these terms, see the glossary, starting on page 140.

See appendix 1, Basic Procedures for Searching the Web (page 129), for tips on how to make the computer and your students "work smarter."

Printing Material

Eventually, your students will need to know how to print the results of their Internet searches. Be prepared to teach them to master this skill.

Cautions

Access to printing often provokes an avalanche of printing activity. Sources are printed without being evaluated for their usefulness. Long backups form at the printer, and valuable time is wasted or articles are lost because the wait is too long. Teach students to evaluate the content of a source before printing. If an article contains a small amount of helpful information, have students record the ideas on paper or save it to a floppy disk. Then they can print it when printer demand has subsided.

Sometimes students see printing an article as the end point of the investigative process. They feel they have accomplished their goal when they have the documents in hand, but they fail to realize that they are responsible for understanding their meaning. If complete items are printed during searches, they must be read, highlighted, marked with margin notes, underlined, or intellectually consumed in some other way. Do not accept a printed item unless it shows evidence of being used. Students are best served when they are held responsible for reading items and then summarizing important, relevant points on note cards, word-processed note pages, or some similar device.

Organizing the Computer Experience

Computer Time

Computer time is frequently at a premium in schools, so you will want to schedule access to the available computers well in advance. Your students will need access to the Internet for 30 to 45 minutes near the beginning of each unit, and several shorter periods of time at the computer as they move through the unit.

Small Groups at the Computer

The ideal situation is to have one or two students at a computer. If this is not possible, form teams of three or four students. Assign tasks, and rotate the jobs frequently.

Roles for Small-Group Members

A four-member team might consist of:

- A search pilot—the child whose fingers touch the keyboard
- A search navigator—the child responsible for deciding where the search pilot should take the search, after consulting with the other group members
- An information recorder—the child responsible for recording reliable, relevant information that will help the group answer the question they are pursuing
- A search communicator—the child responsible for recording important discoveries that are less relevant to the group's question, and sharing the discoveries with other groups that might need the information

Using a Single Computer as a Learning Station

When only one computer is available in the classroom, use it as a learning station through which the teams rotate. When team members at the computer find relevant information, have them print the data and its source so they can take it away from the computer and use it in a small-group meeting to determine its usefulness. Teach the groups to save their sites as bookmarks or record complete addresses so they can find the resources when another portion of computer time is available.

If you use a single computer as a learning station, you must have other resources available in useful quantities, including videotapes, books, articles, prints, displays, and simple laboratory experiments and observation stations. Encourage groups to begin their investigations by gathering information from traditional sources and comparing it with what they find electronically.

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Organizing Groups

Based on Computer Skills

Grouping students can help you cope with differences in the students' experiences with computers. Students with strong computer skills can be mentors to their groups, and especially talented computer users can float to groups that need the mentor's expertise.

Based on Students' Questions

During the engagement phase of the PBL unit, the class will identify five to seven questions to be investigated. They will select these questions from their "What do we need to know?" list. (See pages 28 and 59.) Survey the students to find those interested in the same questions, and form the small groups accordingly.

Based on Ability Levels and Friendships

Grouping options also present themselves around the students' ability levels and friendship patterns. At times, group students by ability levels; but at other times, form groups that reflect a wide range of abilities. Do the same for friendship patterns. Remember that students are expected to individually resolve the problems, working in small groups only when it is the best way to accomplish a task.

Part II

The Coaching Plans, Rubrics, and Problem Logs

The Coaching Plans

The coaching plans presented in this section are designed to be used with each of the seven Problem Logs (pages 59–89) and the eight Problem-Based Learning units presented in part 3 (pages 91–122). Additional coaching ideas are presented in the overview section of each of those eight units.

The Overview of the Coaching Plans chart provided on pages 24–5 will help you align the flow of problem solving, your actions as coach, the students' efforts, and the materials needed during each session.

Time

Coaching plans help the teacher to organize resources, especially time, for an upcoming unit. As you consult the plans in this book, remember that they are not presented as a cookbook. Instead, they are intended to help you guide students through a problem-solving experience similar to one they might encounter in the real world. Expect to find areas in which you will need to spend more time with the class or a group of students in the class, and areas in which you will be able to accelerate the pace suggested in the plan. You also can substitute strategies for the suggestions in the plan, but don't lose sight of the problem as the unit unfolds. Keep the students moving toward resolution, and permit them to be the problem solvers as much as possible.

It is especially important to adjust these coaching ideas to your students' needs. If the pace of an activity is too fast or too slow, make adjustments. When you see a need for help, embed instruction and use an example. Add details or issues to a problem so it is better aligned with your curriculum.

Each unit is divided into 14 sessions in the coaching plan. (Note: Sessions are shown in pairs when a specific Problem Log or other instructional activity is likely to unfold over more than one class session.) Each session is patterned after a 50- to 55-minute period. Make needed alterations where time segments are longer or shorter.

It is hard to predict how long it will take for the pupils to find their websites and collect needed information. Plan on using sessions 3 and 4 for the initial search. In session 8, students will conduct a second search on the Internet, if it is needed.

Group vs. Independent Work

Review the suggestions for forming computer teams (page 16).

As you look over the coaching plans, notice that the students will be grouped differently for almost every session during a unit. The groupings reflect different instructional purposes. During web searches, teams of no more than four students will work together. Groups may be larger during brainstorming. Students work individually when maximum individual responsibility is sought. Whole-class groups are used for embedded instruction and re-teaching based upon assessment results.

A special note. In Problem-Based Learning, each student is held responsible for his or her own resolution of the problem. When more emphasis on team solutions is desired, maintain individual responsibilities for certain activities so that each student feels responsible and accountable for being productive during the unit.

Differentiation

Some of the Problem Logs contain directions for three "pathways" students can follow through portions of the activity. The pathways allow you to differentiate a portion of each log to better fit certain learner characteristics.

- Pathway A presents simpler, more concrete and structured activities.
- Pathway B presents activities for students who are familiar with a featured concept or skill and will benefit from application experiences.
- Pathway C provides activities for students who are comfortable using more complex forms of a concept or skill and thrive in an open, self-directed learning environment.

Suggestions for Differentiating Experiences

As students move through the PBL units, differentiation can be approached in each of the following ways or in a combination of these suggestions.

1. Use alternative pathways where provided in the separate Problem Logs. Create additional pathway options when the opportunity presents itself.
2. As the students investigate each problem, have them use strategies or activities from the Options Supporting Differentiation list that follows. In PBL, learners construct their own knowledge bases during inquiry and therefore will benefit from activities aligned with their abilities, preferences, and needs.

Options Supporting Differentiation

When coaching students during their investigation of any problem, match options listed below with the abilities and preferences of individual students or small groups of students.

Websites:

- Find or use provided websites with more abstract and complex information. These sites can be found by using sophisticated search engines such as Lycos, Webcrawler, or Dogpile.
- Find or use provided websites with more concrete, less abstract information by using search engines designed for kids, such as Yahooligans or Ask Jeeves for Kids.

Internet searches:

- Use Boolean logic to self-direct an Internet search. (For an explanation and examples of Boolean logic, see appendix 1, page 133.)
- Search the Internet using provided key words and search phrases, or use a search engine's pre-established collections of popular websites that are usually included on its home page.

Statistical data:

- Find, organize, and use statistical data to form concepts and generalizations.
- Translate statistical data into verbal statements and graphic displays in order to better understand a concept or generalization.

Using data:

- Extend trends or extrapolate from data in order to speculate on potential consequences of an action or activity.
- Recognize change over time by graphing data about an activity at different periods in time.

During discussion and instructional activities:

- Select main ideas and supporting facts.
- Use data accurately from sources of concrete information.
- Use data accurately from sources of complex information.
- Pick out strengths and weaknesses of websites.
- Classify information into categories.
- Arrange information in sequence.
- Synthesize information from multiple sources into generalizations.
- Distinguish between fact and fiction.

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Options Supporting Differentiation

During discussion and instructional activities: *(continued)*

- Recognize agreement and disagreement in information from different sources.
- Determine reasons for disagreements in evidence.
- Recognize obvious bias in information.
- Recognize consistency and reasonableness in sources.
- Identify subtle bias in information.
- Recognize propaganda.
- Make reasonable inferences from evidence.
- Reach logical conclusions.
- Distinguish relevant from irrelevant facts.
- Evaluate information for reliability.
- Identify new problems arising from solutions to old problems.
- View issues from multiple perspectives.
- Self-assess performance on activities.
- Propose self-regulated plans for segments of the problem-solving process.

Solution Products

During the solution-building phase of each problem, each student will assemble a product to communicate his or her solution to the problem. The products are generally modeled after authentic products you might expect from stakeholders that your students are representing.

In the chart opposite, solution products are listed for each of the eight PBL units. You can replace these solution products with alternative products that more strongly use the spatial, linguistic, mathematical, musical, interpersonal, or kinesthetic talents of your students. For example, it might be possible to substitute a solution in poetic form instead of expository form (a memo), or as a diagram instead of a mathematical explanation.

Solution product:
A plan, invention, memo, cartoon, news article, dance routine, song lyric, impact study, and so on, that would be produced by a real-world stakeholder facing the same problem. A product is usually suggested in the opening scenario for each unit.

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However, be careful not to compromise the authenticity of the unit by mismatching the form of the solution product with the form in which it would most likely appear in the real world. As an example, a scientist explaining how to care for a bat (as in Unit 1: What's That Strange Creature in the Tree?) is not likely to communicate the information through dance or poetry. Conversely, a dancer working out a routine for a children's musical that involves a bat is not likely to write a report on bats to communicate the idea of how bats can be portrayed in dance.

Solution Products to Close Each PBL Unit

Unit Number and Title	Solution Product
1. What's That Strange Creature in the Tree?	A letter to a child from a scientist, with advice on keeping bats as pets
2. Can the Food Pyramid Help?	A weekly food menu from a dietitian for two children with particular dietary characteristics
3. What's the Moral of the Story?	A new illustrated children's fable (Children can also create a dramatic video version as told by a storyteller.)
4. Does This Jesse Owens Story Belong in Our Magazine?	Edited copy of a 200-word magazine article by a journalist, ready for publication
5. Which Countries Will Get Our Help Next Year?	A list of impoverished countries generated by an economist, with recommendations for economic aid
6. How Am I Going to Survive until I'm Rescued?	A survival plan by a teenager marooned in the Canadian wilderness
7. What Should Be Done about These Children?	A new law written by legislators regarding children working in textile mills in the 1840s (historical problem)
8. Who Else Should Be Invited to Join the League?	A list of cities to fill openings in a new soccer league, with rationale, developed by a league executive

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Overview of the Coaching Plans

PBL Phase	Session(s)	Teacher is	Students are	Materials
Engagement	1 and 2 (pp. 27–30)	• Introducing the PBL process • Presenting the problem • Facilitating an action plan	• Learning about the PBL process • Becoming involved in the problem • Forming an action plan: identifying facts, hunches, and questions; scribes are recording them in 4-columned chart on chalkboard and copying for future use (page 28)	• Problem Log 1, Parts 1–3 (pp. 59–63) • A unit problem scenario • Chalkboard and chalk • Newsprint and markers (or a transparency) • Rubrics (optional) selected from numbers 1, 8, and 14–5
Investigation	3 and 4 (pp. 30–2)	• Helping students organize their investigations • Monitoring the investigations and keeping students focused • Providing embedded instruction as needed by the students	• Conducting an Internet search for information • Determining information relevance and reliability • Organizing data	• Action plan from session 1 • Computers with Internet access • Problem Log 2, Parts 1–4 (pp. 64–70) • Rubrics (optional) selected from numbers 2–10 and 13–5

Investigation (continued)	5 and 6
	(pp. 33–4)
		• Making sure information flows among small groups
		• Helping students to:
		  • Sharpen their thinking skills about the process
		  • Gather relevant and reliable information
		  • Recognize bias
		  • Make logical summaries from collected information
			• Working in small groups
			• Isolating components of the problem
			• Summarizing information on puzzle pieces
			• Assembling puzzle pieces on wall (or bulletin board)
				• Students' completed Problem Log 2
				• Problem Log 3 (pp. 71–2)
				• Scissors
				• Tape (or bulletin board and map pins)
				• Rubrics (optional) selected from numbers 2–10 and 13–5

Investigation (continued)	7 and 8 (pp. 35–7)	• Helping students define the problem • Monitoring the investigations and keeping students focused	• Defining the problem • Identifying criteria that lead to an acceptable solution • Conducting a second Internet search for information, if needed	• Problem Log 4, Parts 1–2 (pp. 73–5) • Problem Log 5, Parts 1–2 (pp. 76–80) • Computers with Internet access • Rubrics (optional) selected from numbers 2–11 and 13–5

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Overview of the Coaching Plans *(continued)*

PBL Phase	Session	Teacher is	Students are	Materials
Solution Building	9 and 10 (pp. 38–40)	• Probing connections between evidence and problem definitions • Challenging inconsistencies between conclusions and evidence • Encouraging creative responses to identified problems • Helping students recognize the consequences of alternative solutions • Monitoring students' progress	• Brainstorming the range of solutions to the problem • Considering positive and negative consequences of various solutions • Begin to recognize ethical implications of proposed actions	• Problem Log 5, Part 3 (pp. 81–2) • Problem Log 6, Parts 1–2 (pp. 83–6) • Rubrics (optional) selected from numbers 2–11 and 13–5
Solution Building (continued)	11 (pp. 40–1)	• Introducing ethical implications of proposed actions	• Considering five ethical appeals • Applying ethical appeals to proposed actions	• Problem Log 6, Part 3 (pp. 87–8) • Rubric (optional)—number 12
Solution Building (continued)	12 and 13 (pp. 41–2)	• Monitoring students' progress on solution products • Observing and facilitating student presentations of solution products	• Working on their solution products (session 12) • Presenting their solution products (session 13)	• Appropriate materials for students' solution products
Debriefing	14 (pp. 43–4)	• Reviewing and re-teaching concepts and skills as needed • Extending unit goals and objectives to parallel or contemporary situations • Raising issues of metacognition	• Reviewing concepts and skills • Applying unit goals and objectives to parallel or contemporary situations • Analyzing their work	• Problem Log 7 (p. 89) • Rubric (optional) selected from numbers 1–16, especially 16

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Preparation

It is important for you to become familiar with the material before you begin the first session.

1. Begin by selecting a Problem-Based Learning unit from part 3. (For example, select unit 1, What's That Strange Creature in the Tree? on pages 91–4.)
2. Read the overview information. (For unit 1, the overview is on pages 91–2.)
3. Read the unit's problem scenario. (For unit 1, the scenario is on pages 93–4.)
4. Review the Coaching Plans, starting on page 27. Suggestion: Make a copy of the Problem Logs (pages 59–89) to follow along as you review the Coaching Plans for the first time.
5. Read the seven Problem Logs (pages 59–89) in detail.
6. Review Overview of Thinking Skills in the Problem Logs (pages 57–8). Before you begin each session, be sure you are familiar with the thinking skills featured in each Problem Log, as well as its purpose. (See the list at the beginning of each session.)
7. Decide whether you are going to use all or part of the Problem Logs for instruction, assessment, or both. Suggestions for using the Problem Logs for authentic assessments are presented on pages 3, 45–55, and in the Coaching Plans. If a log will be used for assessment, construct appropriate standards using the master rubric (pages 48–55), or create your own.
8. Preview websites if you plan to send students to specific sites. Even the websites suggested in this book must be visited before using them with the class. Sites may go out of date, be radically altered, or disappear after the publication of this book. You may also want to substitute or supplement with sites of your own. Remember to bookmark so you can access websites easily.
9. Photocopy your assessment standards, the scenario, and the pages of the Problem Log that you will be using. Make one copy for each student.
10. Share your assessment plans with the students, giving them a chance to review the standards before they begin their work. Segments of Problem Logs used for assessment should be assessed and returned promptly so that you can re-teach poorly understood concepts and students have tools to monitor their own progress.

Sessions 1 and 2—Engagement

Sessions 1 and 2 constitute the engagement phase of the unit, during which you draw students into the situation, help them to define their role (or stake) in the problem, and generally get them interested and involved. Session 1 could end when students complete Part 1 or at a convenient point during Part 2 of Problem Log 1. Session 2 should take students through the end of Problem Log 1.

Purpose

- To introduce Problem-Based Learning
- To introduce the scenario and problem in the selected unit
- To set up the inquiry that will follow session 1, using an action plan

Materials

Photocopies (one for each student):

- Scenario for the unit (selected from pages 91–122)
- Problem Log 1, Parts 1–3 (pages 59–63)
- Rubrics (optional)—appropriate rubrics include 1, 8, and 14–5

Chalkboard and chalk

Newsprint and markers (or transparency)

See pages 44–55 for assessment information and rubrics you can use with the Problem Logs. Sixteen model rubrics are provided.

Opening the Unit and Sessions 1 and 2

Tell the students that during this unit they are going to solve a real-world problem. Introduce the concept of Problem-Based Learning, and establish yourself as the "coach" and the students as "stakeholders," or problem solvers. Explain the students' responsibilities as stakeholders in the problem. Because each student has a stake in the problem, each student will be responsible for solving it.

Ill-structured problem:
A problem resistant to solution by simple formula, like many problems found in the real world.

Procedure

Overview: Unit Scenario and Problem Log 1, Getting Started

1. **Distribute copies of the selected unit scenario (pages vary depending on unit assigned) and Problem Log 1 (pages 59–63).** (If the log, or any part of it, will be used for assessment, distribute and discuss the rubric[s] you will be using to judge performances.)
2. Have the students read the first problem log page (page 59), which is a general introduction to the process of opening an investigation. Discuss the analogies to scientists and detectives.

If your students don't know the word "scenario," teach it before they begin the unit.

3. Point out that Problem Log 1 consists of three parts, in addition to the opening page:
   - Part 1—What Do I Know?
   - Part 2—What Are My Hunches?
   - Part 3—Fact or Opinion?

Unit Scenario

4. Ask the students to read the unit scenario. Talk about their impressions of the situation.

Problem Log 1, Part 1

5. Ask the students to turn to Problem Log 1, Part 1. Talk about the task the students will be performing. Have the students work independently to complete Problem Log 1, Part 1.
6. While the students are working, divide the chalkboard into four sections as in the sample below, to create a Problem-Based Learning Action Plan in the form of a four-column chart. The four questions in this plan can frame and organize the opening discussion of any PBL unit and begin the inquiry process.

PBL Action Plan

1. What do you know?	2. What are your hunches?	3. What do you need to know?	4. How can you find out?

7. Ask the students to share facts they recorded on Problem Log 1, Part 1. Discuss the nature of facts, and ask for distinctions between facts and opinions or beliefs. Record relevant facts in the first column of the PBL Action Plan (What do you know?). Use students as "scribes" or recorders at the chalkboard so you can concentrate on the discussion. At the close of the session, ask the scribes to make a copy of the material in the PBL Action Plan on newsprint or a transparency so that in the future it can be hung on a classroom wall or be projected.

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Helpful questions to ask while working through the PBL Action Plan include:

- What is this scenario (or story) about?
- What facts do we know? What facts do we still need to know?
- What questions will help us to find important facts and information? What will make a question useful for our investigation?
- What sounds like a fact but might be something else?
- How can we decide whether what we find is true or false, fact or opinion?

Problem Log 1, Part 2

8. Ask the students to turn to Problem Log 1, Part 2. Read and discuss the instructions for Part 2.
9. Have the students work independently to complete Part 2.
10. Ask the students to share their hunches with the class. Record relevant hunches in the second column of the PBL Action Plan. Discuss the nature and importance of hunches in general and the students' hunches specifically.
11. Now have the students turn their attention to the questions they created. Ask, "Which of our hunches are about something so important that we should figure out whether they are true or false?" Circle the most important hunches on the PBL Action Plan. After discussion, ask, "What questions will help us find out whether an important hunch is true—whether it is a fact? Or, using a more general strategy, what do we need to know to understand our problem better?" Have the scribes record the questions on the PBL Action Plan, under "What do you need to know?" Also have them record the questions on notebook paper so the questions are available for the next session.

Coaching questions that help students to focus their inquiry on hunches include:

- What could be going on that we don't know about?
- What might happen if . . .?
- What other people might be involved in this problem?
- What makes you think that's happening?

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Problem Log 1, Part 3

12. Ask the students to turn to Problem Log 1, Part 3. Point out the "pathway" information near the top of the page (the letters A, B, and C). Explain that there are three choices for working on this activity. Assign each student to pathway A, B, or C, or let the students choose their own pathways. The student will circle a letter to let you know which choice was followed.
13. Have the students work independently to complete their assigned or selected activities in Part 3. Use the students' responses for discussion.
14. Collect any student work that will be used for assessment. Be sure to revisit difficult concepts or skills if the students demonstrate a general lack of understanding or inability to use a skill with expected proficiency.

To review information on the pathways, see page 20.

Sessions 3 and 4—Investigation

Sessions 3 and 4 start the investigation stage of the unit—an investigation that continues through session 8. Session 3 could end when students complete Part 2 of Problem Log 2. Part 3 should be completed during session 4; Part 4 can be started. Students can complete Part 4 out of class.

Purpose

- To prepare for and conduct a search for new information
- To organize and evaluate information discovered in order to get a better understanding of the problem

Materials

PBL Action Plan (see page 28) along with list of questions from previous session

Computers with Internet access

Photocopies (one for each student):

- Problem Log 2, Parts 1–4 (pages 64–70)
- Rubrics (optional)—appropriate rubrics include 2–10 and 13–5

Opening Sessions 3 and 4

Display the students' questions from the previous session. Ask students to add questions to the "What do you need to know?" portion of the PBL Action Plan that have come to mind since the last session. Identify five to seven high-priority questions. These questions will be the first targets of the students' web searches. Then, create teams

of three or four students. Create the groups around students' interest in the high-priority questions. Ask student groups to brainstorm on the final question in the PBL Action Plan (How can you find out?). Record responses as part of a whole-class discussion.

To review suggestions for organizing teams, see page 16.

Helpful coaching questions used during initial investigations include:

- Where can you look for the information you need to answer these questions?
- Why is that information important?
- How will you know whether you can trust the information you find?
- Is the information fact or opinion? How can you tell the difference?
- How can you organize your information?
- What should you do when some information doesn't agree with other information?
- How do your hunches stand up to collected information?

Procedure

Overview: Problem Log 2, Searching the Internet

1. **Distribute copies of Problem Log 2 (pages 64–70).** (If the log, or any part of it, will be used for assessment, distribute and discuss the rubric[s] you will be using to judge performances.) Point out to the students that Problem Log 2 consists of four parts, in addition to the opening page:
   - Part 1—Using Web Addresses (URLs) to Visit the Web
   - Part 2—Is the Information Relevant? Is It Reliable?
   - Part 3—Following Links
   - Part 4—What's the Answer to Your Question?
2. Ask students to read the first page of the log (page 64), which contains general introductory information. Discuss with the students the idea that information must be *relevant* and *reliable.* Define and discuss *links*.

Links:
Electronic connectors between sites on the Internet. Information on page 68 will help students work with links.

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Problem Log 2, Parts 1, 2, and 3

3. Ask the students to turn to Problem Log 2, Part 1. Have the students write their question in the Question Box in Part 1.
4. Assign or assist the class in selecting a search engine to use. Have the students write the name of the assigned search engine in the space on Part 1.
5. Have the students go to the computer site. Instruct each group to begin with one of the provided URLs.
6. Instruct students to enter relevant, reliable information that they find, writing in the Notes Box on Part 1. Have them respond to the questions on Parts 2 and 3.

For tips on links and search techniques, see Appendix 1, Basic Procedures for Searching the Web (page 129). In particular, see the sections on Using Links to Extend a Search (page 131) and Planning and Executing an Independent Search (page 132).

Problem Log 2, Part 4

7. Ask the students to turn to and complete Problem Log 2, Part 4. Think of each student's answer (summary) as being the result of important critical thinking (that is, the ability to arrive at logical conclusions based upon relevant, reliable information). As students share what they wrote in the Summary Box on page 69, concentrate discussion on the importance of their information and conclusions for better understanding the problem.
8. Point out the "pathway" information (the letters A, B, and C) at the top of page 70. Explain that there are three choices for working on this activity. Assign each student to pathway A, B, or C, or let the students choose their own pathways. Ask students to circle a letter to tell you which choice was followed.
9. Have the students work independently to complete their assigned or selected pathways as described on page 70. Use the students' responses for a discussion of what it takes to find relevant, reliable information on the Internet.
10. Collect any student work that will be used for assessment. Revisit difficult concepts or skills as needed.

Sessions 5 and 6—Investigation *(continued)*

Sessions 5 and 6 continue the investigation of the problem. Session 5 could end after discussing Part 4 of Problem Log 2 and beginning the construction of the puzzle as described in Problem Log 3. Session 6 can be used to complete the puzzle and build conclusions about the problem. At this point in the unit, each small group has obtained important information during its Internet searches. The first goal of this session is to be sure information flows among the small groups. The second goal is to be sure students are:

- Sharpening their thinking skills about the process of gathering relevant information
- Making sure information is reliable
- Reconciling differences in collected information
- Making logical summaries from collected information
- Recognizing bias in the information they collect

During sessions 5 and 6, even greater organization of the facts and summaries can be achieved by using puzzle pieces of different colors to signify clusters of facts pertaining to a significant concept or issue.

Purpose

- To think about issues in the problem and how the information gathered relates to those issues

Materials

Students' completed Problem Log 2

Photocopies (one for each student or small group, plus a supply of Universal Puzzle Pieces for making future additions to the map):

- Problem Log 3 (pages 71–2)
- Rubrics (optional)—appropriate rubrics include 2–10 and 13–5

Scissors

Tape (or bulletin board and map pins)

Coaching questions that help students to focus the inquiry include:

- Where did you find your information?
- How do you know it is reliable?
- Did you find information that disagreed with other information?
- How will you decide what information to use if there is disagreement?
- Are you working with facts or with opinions and beliefs?
- How does your information help you better understand the problem?
- Is your conclusion logical, based on your evidence?
- What do we still need to know?

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Opening Sessions 5 and 6

You may want to preview for students their goals for these sessions, as described above. Remind them that solving problems involves sharing and evaluating information.

Procedure

Overview: Problem Log 3, Putting the Puzzle Together

1. Discuss students' responses to the activities they completed in Part 4 of Problem Log 2.
2. **Distribute Problem Log 3 (pages 71–2).** (If the log, or any part of it, will be used for assessment, distribute and discuss the rubric[s] you will be using to judge performances.) Point out that Problem Log 3 has only one part.

Keep the assembled puzzle pieces in place during the entire investigation. Also, keep a supply of blank puzzle pieces available at all times. Students will add pieces to the puzzle as new issues are discussed and new information is discovered. The puzzle board can become a running record of the students' efforts to understand and solve the problem.

Problem Log 3

3. Go over the instructions to Problem Log 3 with the class. Discuss the analogy of their information being puzzle pieces. Explain to the students that as the discussion unfolds (as described at step 5 below), puzzle pieces will be taped or pinned in one location, and the class will begin constructing a complete puzzle representing what is known about the issues in the problem.
4. Decide how you wish to build a puzzle: whether each student will add a piece to the puzzle, or whether the small group will discuss and write information on one piece of the puzzle. Have the students re-form the same small groups from their work on Problem Log 2. Ask each group to decide what they will write on their piece (or pieces) of the puzzle.
5. Rather than ask each group to report on what it found during its Internet searches, encourage the sharing of information through large-group discussion. Initiate discussion by asking, "Who found something that all of us should know?" Organize the information in the form of a large jigsaw puzzle taped to a wall or pinned to a bulletin board. Before any student or group of students can add a piece to the puzzle, the significance of the piece must be explained and linked to pieces already on the wall.
6. Collect any student work that will be used for assessment. Revisit difficult concepts or skills as needed.

Sessions 7 and 8—Investigation *(continued)*

Sessions 7 and 8 complete the investigation phase of the unit. Students will experience how problems need to be defined before they can be resolved. Session 7 could end when the students finish Parts 1 and 2 of Problem Log 4 and begin identifying new questions that need to be answered. Session 8 takes students back to the Internet for a second investigation and should end with the completion of Part 2 of Problem Log 5. The activities in Problem Log 5 also provide an opportunity to help students learn how to structure their own Internet searches (if they are ready for this responsibility), and then practice the necessary skills.

Purpose

- To construct a thorough definition of the problem
- To refine search techniques

Materials

Computers with Internet access

Newsprint and markers (or transparency)

Photocopies (one for each student):

- Problem Log 4, Parts 1 and 2 (pages 73–5)
- Problem Log 5, Parts 1 and 2 (pages 76–80)
- Rubrics (optional)—appropriate rubrics include 2–11 and 13–5

Opening Sessions 7 and 8

Begin by asking why it is important to define a problem before trying to solve it. Tell students that in these sessions, they'll define the problem completely in preparation to finding good solutions. A *complete* definition includes the issue or question to be resolved and lists important rules, criteria, or conditions that must be accounted for by the chosen solution.

Procedure

Overview: Problem Log 4, What Is the Problem?

1. **Distribute Problem Log 4 (pages 73–5).** (If the log, or any part of it, will be used for assessment, distribute and discuss the rubric[s] you will be using to judge performances.) Point out that Problem Log 4 has two parts in addition to the opening page:
   - Part 1—The Big Question!
   - Part 2—The Rules to Follow
2. Discuss the two-part nature of complete problem definitions. Present a simple problem: "Suppose you were standing on one side of a very busy highway at rush hour and wanted to get to the other side. How would you define your problem?" Students are likely to respond with a simple question: "How can I get to the other side of the road?" Record a sample question or two on the chalkboard and then ask for examples of possible solutions. Record the solutions on the chalkboard. Then ask, "Are any of these solutions better than others?" Encourage the students to look for reasons why one or two seem to be the best. Then point out that any solution that got the person to the other side of the street solved the problem, but solutions that take into account the safety of the walker and follow pedestrian laws are best.

Good definitions include important rules or details that will make some solutions acceptable and others unacceptable. Solutions to the problem of how to cross a busy highway must: 1) be safe for the walker and 2) not break laws or put drivers in danger. Solutions not meeting these **criteria** are unacceptable.

Problem Log 4, Parts 1 and 2

3. Have the students turn to Problem Log 4, Parts 1 and 2. Assign appropriate pathways for Part 2.
4. Give the class time to do Problem Log 4, Parts 1 and 2.
5. Complete the development of a two-part definition of the problem that is acceptable to a majority of the class. Also note alternative versions. Post the definition and alternatives in the room. Explain that anyone can suggest changes for the class definition when they have information to back up their suggestion, but the class members must agree to accept the change.
6. Ask the students if they have any questions about the problem that still need to be answered. On newsprint, add their questions to questions that remain from earlier sessions of the unit. Tell the students that they will have one more opportunity to use the Internet, and these questions will be the targets of their inquiry.

Overview, Problem Log 5, Planning Your Internet Search

7. **Distribute Problem Log 5 (pages 76–82).** (If the log, or any part of it, will be used for assessment, distribute and discuss the rubric[s] you will be using to judge performances.) Point out that Problem Log 5 has three parts in addition to the opening page:
   - Part 1—What Do I Need to Know?
   - Part 2—Doing a Search
   - Part 3—Did I Find New Pieces to the Puzzle? (covered in session 9)

Problem Log 5, Part 1

8. Go over the introduction and instructions for Part 1. Ask the students to select a question remaining from session 1 and write it in the What Do I Need to Know? box.
9. Group the students into teams organized around the questions they selected. Have them complete Part 1 of the Problem Log.
10. Discuss examples of how questions can be made more general and more specific and how synonyms can help a search. Tell the students the location of an online thesaurus as well as a printed version in the classroom.

Problem Log 5, Part 2

11. If students would benefit from direct instruction on the search strategies used in Part 2 of the log, ask them to turn to Problem Log 5, Part 2, Doing a Search. Discuss the three searching methods described there.
12. If time is available, have the students begin their second Internet searches; otherwise, have them begin their searches during the next session. In-class time to carry out a second Internet search is helpful because it provides students with practice in search skills under the watchful guidance of their coach.
13. Collect any student work that will be used for assessment. Revisit difficult concepts or skills as needed.

Sessions 9 and 10—Solution Building

In sessions 9 and 10, students begin to build solutions to the problem they have now explored in depth. Session 9 could end after students add new information to the puzzle by completing Part 3 of Problem Log 5. During session 10, students complete Parts 1 and 2 of Problem Log 6. These sessions expose students to several important aspects of problem solving. Unresolved questions must be taken care of and students need to see how fresh information has the potential to change a problem's definition. Students are also given an opportunity to see that consequences, both positive and negative, are likely to result from almost any solution they propose. Expert problem solvers recognize that these consequences need to be managed. When students reach session 11, they will experience that solutions often involve conflicting ethical appeals. "Right" solutions can be defended ethically.

Purpose

- To experience how fresh information can change a problem definition
- To consider consequences when solving problems

Materials

Photocopies (one for each student):

- Problem Log 5, Part 3 (pages 81–2)
- Problem Log 6, Parts 1 and 2 (pages 83–6)
- Rubrics (optional)—appropriate rubrics include 2–11 and 13–5

Opening Sessions 9 and 10

Begin by discussing newly discovered information that might have an impact on the problem. Add important information to the puzzle on the bulletin board or wall, which was begun in session 5. (For review, see page 34.)

Procedure

Problem Log 5, Part 3

1. Ask the students to turn to Problem Log 5, Part 3. Assign pathways. Have the students work independently to complete Part 3.
2. Discuss the metacognitive insights recorded in Think about Your Thinking boxes.

Overview: Problem Log 6, How Should the Problem Be Solved?

3. **Distribute Problem Log 6 (pages 83–8).** (If the log, or any part of it, will be used for assessment, distribute and discuss the rubric[s] you will be using to judge performances.) Point out that the log has three parts in addition to the opening page:
   - Part 1–What Are the Possibilities?
   - Part 2–Both Good and Bad Things Can Happen
   - Part 3–What Is the Best Thing to Do? (covered in session 11)

Problem Log 6, Part 1

4. Organize the class into small groups for a brainstorming session. (The brainstorm will benefit if groups are made up of students with diverse knowledge backgrounds.)
5. Discuss the introduction and instructions for Part 1.
6. Allow about 20 minutes for brainstorming.
7. As the groups report their results, list the solution ideas on the chalkboard. Tell the students they can use any of the ideas when they build their own solutions.

Questions often used during solution building include:

- What needs to be done or changed?
- What good and bad things will happen because of the solution?
- Why is this better than that?
- Why is this the best thing to do?
- How will the problem change because of what you do?
- What will still need to be done after you put your solution into effect?

Problem Log 6, Part 2

8. Ask the students to turn to Part 2 of the problem log. Assign students Pathways A, B, or C. Discuss the instructions, and reinforce the analogy of the tree by drawing a tree (however crude) on the chalkboard. Label your drawing with PROBLEM, SOLUTION, + CONSEQUENCES, and – CONSEQUENCES.
9. Have the students work independently to complete Problem Log 6.

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10. Have the students form small groups. Each small group will select one of the solution ideas from the chalkboard. Allow 15 minutes for the groups to identify likely positive and negative consequences that would come from using the solution idea.
11. Have the students re-form in a large group. Ask a spokesperson from each small group to share examples of good and bad consequences.
12. Discuss the difficulty of controlling consequences and the likelihood that everyone will face some negative consequences.
13. Collect any student work that will be used for assessment.
14. Close the session by establishing the actual day the solution products will be collected and the form the products will take.

Review the solution products information on page 22.

Session 11—Solution Building *(continued)*

In session 11, students practice applying ethical appeals to solutions, using a sample problem. In Problem Log 6, Part 3, students are introduced to five ethical appeals, or reasons why actions are considered good or bad. A good way to acquaint students with these appeals is to apply them to simple ethical choices. Practice with the appeals will help students to form a template for ethical decision making.

Purpose

- To build solutions and defend them
- To apply ethical appeals to specific proposed solutions

Materials

Photocopies (one for each student):

- Problem Log 6, Part 3 (pages 87–8)
- Rubric (optional)—most appropriate is 12

Be sure the students understand and are able to use the terms *ethics* and *ethical*. The words *ethics* and *ethical* refer to the system of moral principles and good choices that people follow in their relationships with others.

Opening Session 11

Begin the session by presenting a sample case: "You ask two friends to help you clean up your yard. They agree, especially when you mention that you will pay them $20 for a day's work. Jenny shows up at 9:00 a.m. and works until 5:00 p.m. Roger starts at 11:00 a.m., works hard at times, and visits with your brother for a while. When 5:00 p.m. comes, you're not sure what to pay your two friends. How much should each be paid? Why is that the right amount?"

Procedure

Problem Log 6, Part 3

1. Ask the students to turn to Problem Log 6, Part 3. Use the five questions based upon the ethical appeals to discuss the sample case. This strategy will challenge your students to come up with answers they can ethically defend. They also will discover that a number of solutions can be defended with the same appeals, and that opposing solutions can often be supported by equally compelling appeals. It should become clear that most solutions produce both positive and negative consequences for someone; and that ethical choices are not always obvious or hardly ever easy, but they are worth the effort.
2. Have the students apply one (or more) of the five ethical appeals to the sample problem (that is, how much to pay each friend for helping to clean the yard).

Session 12—Solution Building *(continued)*

In session 12, students use class time to build their solutions. Giving students time to complete their solution products and the rationales for their choices allows you to mentor those students needing additional help and make observations regarding critical-thinking skills and metacognition that will be helpful during debriefing. Monitor the students closely as they design their products and construct rationales.

Purpose

- To complete solution products and defend them

Materials

Materials appropriate for students' solution products

Procedure

Provide students with the time, materials, and guidance necessary to build their solution products and rationales.

Issues to look for and respond to as students build solutions include:

- Are students distinguishing between facts and opinion?
- Are students making logical conclusions based upon evidence?
- Are students being precise and accurate with information?
- Are students achieving clarity in their solution products?
- Are students sharing information effectively?
- How effectively are groups working?
- What content issues still need to be resolved?
- Are students considering the ethical implications of their solutions?

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Session 13—Solution Building *(continued)*

Session 13 is the culminating moment of the unit, when students present their solution products. The instructions below for session 13 are necessarily very general, because your students may present their solutions in many different ways depending on the unit being studied, the guidelines you provide, and students' choices.

Purpose

- To present solution products and rationales

Materials

Materials appropriate for students' solution products

Opening Session 13

Encourage students to present their solution products in a format that authentically reflects the real world. For example, modern versions of Aesop's fables ("What's the Moral of the Story?") must convey a moral message, just as Aesop's stories did centuries ago, but utilize modern settings and characters. Students can present their fables to real audiences (parents, classmates, children in other classrooms, and so on) as storytellers do today and storytellers would have done in Aesop's time. Then, they were a principal means of communication at a time when so few people were able to read and so few books were available.

Procedure

1. Allow adequate time for the students to complete their solution products.
2. To conclude the PBL unit, simulate a decision-making event in which the stakeholders share insights and work toward resolving their problem. For example, in unit 7 (What Should Be Done about These Children?), students have taken the role of commission members faced with the question of what to do—if anything—about child labor in textile mills. They have investigated the multifaceted problem and developed their own recommendations to solve it. For a powerful way to close that unit, have the "commission members" hold a meeting at which they describe their recommendations to each other. For a variation, they might explore whether the commission, as a group, could—and should—decide on a course of action.

Session 14—Debriefing

Session 14 provides you and the students with a debriefing period. The debriefing period offers you, as the coach, an opportunity to review important concepts and skills, re-teach ideas or skills that are giving the students trouble, extend unit goals and objectives to parallel or contemporary situations, and raise issues of metacognition with the class.

Metacognition: The process of thinking about thinking. In problem-based learning, refers to strategies and attitudes that control the student's actions during problem solving

Questions like the following increase metacognitive awareness:

- How satisfied are you with your work?
- What part of solving this problem was the most difficult?
- What strategies did you use at different times as you solved the problem?
- How might what you learned during this unit help you to solve other problems?
- What accomplishments are you most proud of?
- Were you disappointed about your performance in any way? How can you improve next time?

Purpose

- To retrace strategies and extend insights to new questions

Materials

Photocopies (one for each student):

- Problem Log 7 (page 89)
- Rubrics (optional)—any of the rubrics (1–16); 16 is especially appropriate

Opening Session 14

Let students know that you are going to spend some time thinking and talking about the problem and solutions they have just explored.

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Procedure

Overview: Problem Log 7, Thinking Back

1. **Distribute Problem Log 7 (page 89).** (If the log, or any part of it, will be used for assessment, distribute and discuss the rubric[s] you will be using to judge performances.) Point out that Problem Log 7 only has one part.

Problem Log 7

2. Discuss student reactions to each item.
3. Share your own observations on what was done well and what needs improvement. Use "What if . . ." questions to probe major concepts in the problems. Do this by changing details in the problem or adding something not in the original situation, and ask how the change might affect the students' thinking.
4. Find contemporary or historical events that paralleled the problem, and ask the students to compare them for similarities and differences.
5. Collect any student work to be used for assessment. (During debriefing any of the assessment targets described in the rubrics on pages 48–55 can become the focus of the debriefing. You might also ask the students to determine the overall performance level they achieved during the unit and to describe why they selected the level they did. See Rubric for Target 16 on page 55.)

Using Rubrics for Assessment

How to Use the Rubrics

I strongly recommend that you put quizzes and tests on hold while using these units. In their place, use some or all of the students' Problem Logs, and think of them as an assessment portfolio.

Before using any part of a Problem Log for assessment, decide what you want to examine in your students' work. Targets for assessment, for which you'll find rubrics starting on page 48, are listed below. Limit the number of targets for each assessment (say, three or four). Then decide what standards you will use to judge student performance on each target.

Assessment Targets

1. Collecting key facts, hunches, and questions
2. Planning searches for new information
3. Searching for useful results from relevant, reliable Internet sites
4. Choosing relevant, reliable Internet sites from search results
5. Taking accurate, complete notes
6. Reaching accurate, logical conclusions from relevant, reliable information
7. Knowing the difference between relevant and irrelevant information
8. Knowing the difference between fact and opinion
9. Seeing the differences between reasonable and biased information
10. Deepening understanding with reliable information
11. Defining a problem by stating the big issues and important details
12. Recognizing that finding appropriate solutions involves making choices—often, ethical choices
13. Taking charge of one's own thinking (metacognition)
14. Taking responsibility to be a helpful member of a group
15. Developing attitudes that make one a better problem solver; for example, taking on challenges and being respectful to others
16. Summing up performance

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Key Definitions for Performance Standards	
Term	**The ability to:**
Clarity	Be clear and understandable
Accuracy	Be correct, true, factual, and honest
Precision	Be detailed, specific, and exact
Relevance	Stay connected to the topic in a meaningful way
Depth	Go beyond simple or superficial understanding of problems and ideas
Breadth	See more than one point of view
Logic	Build ideas or arguments that follow from available evidence

Elder, L., and R. Paul. *Universal Intellectual Standards.* Retrieved May 26, 2001. http://www.criticalthinking.org/University/unistan.htm

A Master Rubric for the Problem Logs (pages 48–55) contains separate rubrics for 15 different, yet related, skills (assessment targets) often used during the problem-solving process, and one summary of overall performance. For each skill, five performance standards are listed that can be used to judge student performance on the targeted skill. The standards reflect key terms defined above: clarity, accuracy, precision, relevance, depth, breadth, and logic.

When you have decided to use a Problem Log for assessment, select an appropriate rubric or rubrics from the Master Rubric, or create your own. Share the rubrics with your students before they begin working on their logs. Select performance standards that:

- Communicate to the students your expectations
- Align with district and state standards, if applicable

Explain how the students can meet those performance standards. Knowing the standards ahead of time will give the students opportunities to self-regulate their efforts.

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Assessment and Individual Differences among Students

Will you hold every student in your class to the same performance standards regardless of significant differences in the student population? This is a question you will have to answer based upon local guidelines as well as your own philosophy regarding assessment and fairness. If you will be holding every student to the same performance standards, rubrics can be developed for the class and applied to everyone. If you will be developing alternative assessment standards for students with significant differences from their classmates, you may wish to negotiate standards with individual students. Whichever case exists in your classroom, be sure your selection of rubrics clearly communicates standards and encourages all students to stretch fully toward their highest potential.

You may want to create a word-processing file from the master rubric. Then you can cut and paste standards from the master rubric into individual rubrics that can be printed and distributed to your students.

A Master Rubric for the Problem Logs

Rubric for Assessment Target 1

Collecting key facts, hunches, and questions

When you first met the problem:

Performance Level	(4) Far Beyond Expectations	(3) Beyond Expectations	(2) Meeting Expectations	(1) Approaching Expectations	(0) Not Yet Approaching Expectations
Performance Standard	You found key facts and formed important hunches and questions.	You found relevant facts and formed relevant hunches and questions.	You mixed relevant with irrelevant facts, hunches, and questions.	You found some facts and formed a few hunches and questions.	Your work cannot be judged.

Comments: _____

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Rubric for Assessment Target 2

Planning searches for new information

In planning your searches on the World Wide Web:

Performance Level	(4) Far Beyond Expectations	(3) Beyond Expectations	(2) Meeting Expectations	(1) Approaching Expectations	(0) Not Yet Approaching Expectations
Performance Standard	You used key words, their synonyms, and more than one version of a search phrase.	You used key words, a few synonyms, and a search phrase.	You used key words and a search phrase.	You used irrelevant search words and a vague or irrelevant search phrase.	Your work cannot be judged.

Comments: _____

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Rubric for Assessment Target 3

Searching for useful results from relevant, reliable Internet sites

You carried out your search of the web:

Performance Level	(4) Far Beyond Expectations	(3) Beyond Expectations	(2) Meeting Expectations	(1) Approaching Expectations	(0) Not Yet Approaching Expectations
Performance Standard	With little or no revision of terms or help from others, and you ended up finding useful sites.	With some help from others, and you needed a little revision of terms before finding useful sites.	With major help from others and revision of terms before finding useful sites.	With difficulty, and you found a relevant site.	Your work cannot be judged.

Comments: _____

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Rubric for Assessment Target 4

Choosing relevant, reliable Internet sites from search results

From your list of sites:

Performance Level	(4) Far Beyond Expectations	(3) Beyond Expectations	(2) Meeting Expectations	(1) Approaching Expectations	(0) Not Yet Approaching Expectations
Performance Standard	You chose key sites, fully explored one or more of them, and checked links to other sites.	You chose relevant sites, explored one or more of them, and checked links to other sites.	You chose a relevant site, looked it over, and checked one or more of its links.	You chose a site and skimmed over its information.	Your work cannot be judged.

Comments: _____

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Rubric for Assessment Target 5

Taking accurate, complete notes

When you looked over a website:

Performance Level	(4) Far Beyond Expectations	(3) Beyond Expectations	(2) Meeting Expectations	(1) Approaching Expectations	(0) Not Yet Approaching Expectations
Performance Standard	You took accurate, detailed notes on important information and the sources of the information.	You took accurate notes on mostly relevant information and the sources of the information.	You took mixed accurate and inaccurate notes on relevant and irrelevant information and kept vague records on sources.	You took few accurate or inaccurate notes on information and did not record sources.	Your work cannot be judged.

Comments: _____

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Rubric for Assessment Target 6

Reaching accurate, logical conclusions from relevant, reliable information

When using the notes from your search:

Performance Level	(4) Far Beyond Expectations	(3) Beyond Expectations	(2) Meeting Expectations	(1) Approaching Expectations	(0) Not Yet Approaching Expectations
Performance Standard	You reached logical, important conclusions from reliable information.	You reached logical conclusions from reliable information.	You reached both logical and illogical conclusions, using reliable information.	You reached simple, and sometimes illogical, conclusions using both reliable and unreliable information.	Your work cannot be judged.

Comments: _____

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Rubric for Assessment Target 7

Knowing the difference between relevant and irrelevant information

When checking information to see how useful it is:

Performance Level	(4) Far Beyond Expectations	(3) Beyond Expectations	(2) Meeting Expectations	(1) Approaching Expectations	(0) Not Yet Approaching Expectations
Performance Standard	You made sure the information is relevant and reliable enough to be trusted.	You know the difference between relevant and irrelevant information.	You see the difference between relevant and irrelevant information when it is pointed out.	You have trouble seeing the difference between relevant and irrelevant information even when it is pointed out.	Your work cannot be judged.

Comments: _____

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Rubric for Assessment Target 8

Knowing the difference between fact and opinion

When checking information to see how useful it is:

Performance Level	(4) Far Beyond Expectations	(3) Beyond Expectations	(2) Meeting Expectations	(1) Approaching Expectations	(0) Not Yet Approaching Expectations
Performance Standard	You know the difference between fact and opinion and when opinions are based on facts.	You know the difference between fact and opinion.	You see the difference between fact and opinion when it is pointed out.	You have trouble seeing the difference between fact and opinion even when it is pointed out.	Your work cannot be judged.

Comments: _____

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Rubric for Assessment Target 9

Seeing the differences between reasonable and biased information

When checking over your information:

Performance Level	(4) Far Beyond Expectations	(3) Beyond Expectations	(2) Meeting Expectations	(1) Approaching Expectations	(0) Not Yet Approaching Expectations
Performance Standard	You point out bias and understand why it exists.	You point out obvious bias when asked to find it.	You see bias when it is pointed out.	You have trouble seeing obvious bias when it is pointed out.	Your work cannot be judged.

Comments: _____

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Rubric for Assessment Target 10

Deepening understanding with reliable information

When investigating a problem:

Performance Level	(4) Far Beyond Expectations	(3) Beyond Expectations	(2) Meeting Expectations	(1) Approaching Expectations	(0) Not Yet Approaching Expectations
Performance Standard	You know when information is needed, how to find it with little help, and how to use it to deepen your understanding of issues.	You know when information is needed, can find it with some help, and can use it to increase your understanding of issues.	You know when information is needed, how to find it with some help, and how to use it to add details to the problem.	You know when information is needed, but you have trouble finding or using it to add details to the problem.	Your work cannot be judged.

Comments: _____

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Rubric for Assessment Target 11

Defining a problem by stating the big issues and important details

When defining a problem:

Performance Level	(4) Far Beyond Expectations	(3) Beyond Expectations	(2) Meeting Expectations	(1) Approaching Expectations	(0) Not Yet Approaching Expectations
Performance Standard	You clearly state the key question and list important details that a solution must include.	You state an important question and list a few details that a solution must include.	You state an important question that can be resolved.	You find an important question with help from others.	Your work cannot be judged.

Comments: _____

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Rubric for Assessment Target 12

Recognizing that finding appropriate solutions involves making choices—often, ethical choices

When you look for a solution:

Performance Level	(4) Far Beyond Expectations	(3) Beyond Expectations	(2) Meeting Expectations	(1) Approaching Expectations	(0) Not Yet Approaching Expectations
Performance Standard	You identify solutions, predict numerous consequences from each, and can answer the question, "What's the right thing to do?"	You identify solutions and some consequences tied to each one.	You see one solution and a few of its consequences.	You see a solution that will change the problem.	Your work cannot be judged.

Comments: _____

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Rubric for Assessment Target 13

Taking charge of one's own thinking (metacognition)

As you work on a problem:

Performance Level	(4) Far Beyond Expectations	(3) Beyond Expectations	(2) Meeting Expectations	(1) Approaching Expectations	(0) Not Yet Approaching Expectations
Performance Standard	You regularly think about your progress, and you improve your strategies as needed.	You sometimes think about your progress and try to come up with better ways to work.	You sometimes think about your progress and use better ways of doing things when shown how.	You don't think about your progress, but improve your work when shown how.	Your work cannot be judged.

Comments: _____

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Rubric for Assessment Target 14

Taking responsibility to be a helpful member of a group

When you are working in a group:

Performance Level	(4) Far Beyond Expectations	(3) Beyond Expectations	(2) Meeting Expectations	(1) Approaching Expectations	(0) Not Yet Approaching Expectations
Performance Standard	You watch its progress, notice and do necessary jobs, and help others without being told.	You listen to others, do jobs you are asked to do, and help the group make progress.	You cooperate and do jobs given to you.	You would like working by yourself most, but get involved in the group when encouraged.	Your work cannot be judged.

Comments: _____

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Rubric for Assessment Target 15

Developing attitudes that make one a better problem solver; for example, taking on challenges and being respectful toward others

When you are working on a problem:

Performance Level	(4) Far Beyond Expectations	(3) Beyond Expectations	(2) Meeting Expectations	(1) Approaching Expectations	(0) Not Yet Approaching Expectations
Performance Standard	You enjoy challenges, build on the ideas of others, and direct and complete your own work.	You accept challenges, listen to the ideas of others, and direct and complete most of your own work.	You accept most challenges, cooperate when asked, and complete most assignments.	You find challenges frustrating, cooperate when asked, and complete most assignments.	Your work cannot be judged.

Comments: _____

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Rubric for Assessment Target 16

Summing up performance

At the end of this problem:

Performance Level	(4) Far Beyond Expectations	(3) Beyond Expectations	(2) Meeting Expectations	(1) Approaching Expectations	(0) Not Yet Approaching Expectations
Performance Standard	You understand the issues well and use skills without making many errors.	You understand most issues well and use skills without making major errors.	You are starting to understand the issues but make some major errors when using skills.	You are starting to understand a few issues but make many major errors when using skills.	Your work cannot be judged.

Comments: _____

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The Problem Logs

There are seven Problem Logs, many with several parts. Each Problem Log features specific thinking skills, as listed below in Overview of Thinking Skills in the Problem Logs.

Note that some of the Problem Logs contain directions for three pathways students can follow through portions of the activity. See pages 20–2 for an explanation of the three pathways.

Overview of Thinking Skills in the Problem Logs

Problem Log Number	Thinking Skills
1	**Students will:** • Construct relevant questions for inquiry • Distinguish fact from fiction and opinion • Distinguish relevant from irrelevant facts • Evaluate the reliability of information • Construct reasonable inferences (hunches) • Self-regulate thinking processes
2	• Evaluate the reliability of information • Recognize relevant information • Take accurate notes • Write an accurate, logical summary of information • Write with clarity and precision • Self-regulate thinking processes
3	• Write an accurate, logical summary of information • Compare facts for agreement and contradiction • Classify facts or ideas by categories • Acquire data accurately through listening
4	• Define a problem precisely • Establish criteria for solutions • View issues from multiple perspectives • Identify possible consequences

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Overview of Thinking Skills in the Problem Logs *(continued)*

Problem Log Number	Thinking Skills
5	**Students will:** • Self-regulate thinking processes • Analyze the meaning of words • Compare and contrast methods • Use criteria to make judgments • Recognize relevant information • Evaluate information for reliability • Write an accurate, logical summary of information • Write with clarity and precision
6	• Generate diverse ideas for solutions • Identify potential consequences • Use criteria for selecting ethical solutions
7	• Self-regulate thinking processes

Adapted in part from: Carpenter, Helen McCracken. *Skill Development in Social Studies. Thirty-Third Yearbook of the National Council for the Social Studies*. Washington, D.C.: National Council for the Social Studies, 1963; and The Center for Critical Thinking. Strategies. Retrieved November, 2000. http://www.criticalthinking.org/k12/k12class/strat/stratall.html

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Name: _____ Date: _____

Problem Log 1 — Getting Started

Solving a problem starts with getting to know all about it. You have to look at the problem just like a scientist looking into a microscope or a detective searching for clues. Here are three steps to help you get started on any problem, including the problem you're about to face.

Step 1. When you first meet a problem, always ask yourself: "What do I know?"

Make a list of important facts.

Step 2. Then ask yourself: "What could be going on in this problem that I don't know about?"

Make a list of your hunches.

Hunches come from your imagination, so be careful. They might not turn out to be true. But hunches are very important because they start you thinking about what needs to be investigated.

Step 3. Finally, ask yourself: "What do I need to know?"

Make a list of questions that can help you figure out if your hunches are true or false.

As you work on your problem, you will use four important words. They are:

- **Problem.** A problem is an unsettled question or issue.
- **Fact.** A fact is something you know is true or real.
- **Hunch.** A hunch is a strong feeling about something.
- **Opinion.** An opinion is a belief or judgment about something.

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Name: _____ Date: _____

Problem Log 1 Part 1

What Do I Know?

1. Read the scenario that opens the problem.
2. List three important facts about the problem. Facts can be about things, like people, places, and objects. They also can be about ideas or feelings.

Fact 1

Fact 2

Fact 3

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Name: _____ Date: _____

Problem Log 1 — Part 2

What Are My Hunches?

1. It's time to fire up your imagination! Picture yourself in the problem. In the Hunches Box, write down at least two things that could be going on in the problem that you can't be sure about—yet.

Hunches Box

I have a hunch that . . .

I have a hunch that . . .

List more hunches if you can.

If you have more hunches, list them on a separate sheet of paper.

2. Hunches are not facts when you first think them up. They become facts if you investigate them and find evidence that they are true. Circle the hunch in the Hunches Box that you think should be investigated because it is about something very important in the problem.

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Name: _____ Date: _____

Problem Log 1 — Part 2 *(continued)*

3. In the Questions Box, list two or more questions that would help you investigate your hunch to see if it is actually a fact.

Questions Box

1.

2.

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List more questions if you can.

If you have more questions, list them on a separate sheet of paper.

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Name: _____ Date: _____

Problem Log 1 Part 3

Pathway: A B C

Fact or Opinion?

Directions for Pathway A

Look at the facts you listed in Part 1. Choose one fact and write it on the first line below. On the next two lines, explain how you would convince one of your classmates that this is a fact.

_____

_____

_____

Write on a separate sheet of paper if you need more space.

Directions for Pathway B

Suppose you are trying to answer one of your questions from Part 2. You look in two different sources for information. The sources disagree on the answer to your question. How would you decide which source to trust?

_____

_____

_____

Write on a separate sheet of paper if you need more space.

Directions for Pathway C

1. Suppose you investigated an important question. Now you want to write or tell a classmate about what you learned. Is it OK to share your opinions along with facts?

   (Circle one word) Yes No Maybe

2. Explain why you should or should not share your opinions, along with the facts, from an investigation.

_____

_____

_____

Write on a separate sheet of paper if you need more space.

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Problem Log 2 — Searching the Internet

Real-world problems usually come to us without enough information to understand them at first. This means we have to decide what we need to know and where to find the information we want.

Problem solvers often take their questions to the Internet, especially the World Wide Web ("the web"). More information is stored on the Internet than has ever been available to anyone since the beginning of human history.

Finding information is easy when you know its address. When you have found it, deciding whether you can use it sometimes is difficult.

Problem Log 2 has four parts:

- **Part 1**—Using Web Addresses (URLs) to Visit the Web
- **Part 2**—Is the Information Relevant? Is It Reliable?
- **Part 3**—Following Links
- **Part 4**—What's the Answer to Your Question?

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Name: _____ Date: _____

Problem Log 2 Part 1

Using Web Addresses (URLs) to Visit the Web

1. Write the question you are investigating in the Question Box.

Question Box

2. On the lines, write the two URLs you will be using.

   URL #1 _____

   URL #2 _____

3. Name the search engine you will use: _____
4. Type one of the URLs in the search engine's dialog box. (Type carefully! Typing errors are the #1 reason searches don't work.)
5. Click GO or SEARCH and wait for the website to appear.
6. Bookmark the site.

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Name: _____ Date: _____

Problem Log 2

Part 1 *(continued)*

7. Search for information that answers the question in the Question Box. Write notes in the Notes Box about the information you find.

Notes Box

Who put the information on this website?

Important! When you note information exactly the way you find it, put quotation marks around it.

If you have more notes, list them on a separate sheet of paper.

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Name: _____ Date: _____

Problem Log 2 Part 2

Is the Information Relevant? Is It Reliable?

Relevant information helps you answer your question.

Look at the information in your Notes Box. Cross out any information that is not relevant.

Reliable information is information you can trust.

Look at the information in your Notes Box again. Put a check mark (✓) next to information that might be unreliable. These questions should help you find information that might be unreliable.

- ❑ Who created or collected the information at the site?
- ❑ Has the information been created or collected by an expert?
- ❑ Does the site present different sides on an issue?
- ❑ Is the site interested in "selling" you a product or an idea?
- ❑ When was the site last updated? Does the age of the information make it less reliable?

Look at the information you checked. Then answer this question:

Why is it sometimes difficult to know whether information is reliable or not?

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Problem Log 2

Part 3

Following Links

To search other places like the one you started with, see if your website has *links*. You can spot a link because it is written in a different color than the words around it, or it may be underlined. Links might be in a list at the left, right, or bottom of your computer screen.

It's simple to use a link. Just put the mouse arrow on the highlighted words, and click.

When you find information through a link, check it out using the same two questions you used at the original site:

Is the information relevant?

Is the information reliable?

If you are satisfied the information is relevant and reliable, make notes about it in the Notes Box for Links.

Notes Box for Links

Who put the information on this website?

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Remember to use quotation marks if needed.

Write on a separate sheet of paper if you need more space.

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Name: _____ Date: _____

Problem Log 2 — Part 4

What's the Answer to Your Question?

Answer the question you were investigating at the start of this Problem Log. Use information you collected from your search on the Internet. Be sure your ideas are clear and supported by the information you found. Write your answer in the Summary Box.

Summary Box

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Write on a separate sheet of paper if you need more space.

Name: _____ Date: _____

Problem Log 2 — Part 4 *(continued)*

Pathway: A B C

Thinking about Thinking

Directions for Pathway A

In the box, write at least two examples of how the websites you used were helpful or not helpful.

Directions for Pathway B

In the box, either:

Write two examples of what you did to make your search successful.

Or:

Write two examples of what you would do next time to improve your search.

Directions for Pathway C

In the box, create an equation that explains what it takes to find useful information on the Internet. Then, in words, explain how the equation works.

Your equation might look like this:

E (effort) + L (luck) = A successful search

Thinking about Thinking

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Name: _____ Date: _____

Problem Log 3 Putting the Puzzle Together

Your problem is like a big jigsaw puzzle. Each piece of information you find puts a little more of the puzzle together. You need to put together lots of pieces of information to understand the whole puzzle—to see the big picture.

Your search of websites turned up some pieces to the puzzle. When the pieces are put together, parts of the big picture should come into view.

There is a blank puzzle piece on the next page. On it, write one or two sentences summarizing important information you and your group found during your web searches.

Cut out your puzzle piece and fit it together with the puzzle pieces your classmates made. As you think about information you and the other students have found, the "big picture" will begin to emerge.

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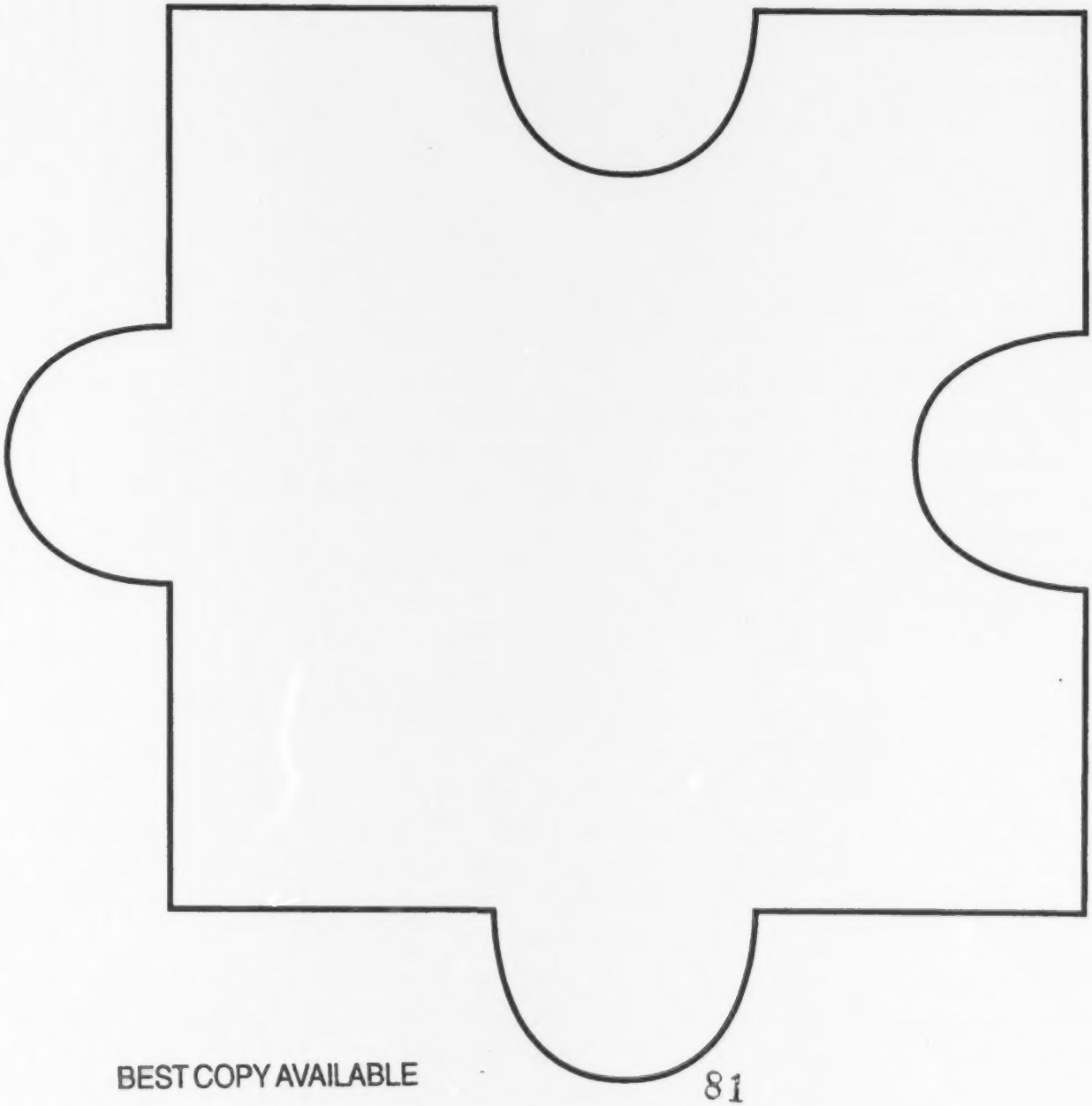
Name: _____ Date: _____

Problem Log 3 *(continued)*

Universal Puzzle Piece



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Problem Log 4 — What Is the Problem?

Sometimes people rush to find a solution without knowing what they are looking for. They don't have a clear picture of what the problem is about. In problem solving, a picture of the problem is called the problem's *definition.*

The more you learn about a problem, the clearer its picture should get. That's why you are asking questions and gathering information—to get a better picture of your problem.

Now it's time to see just how clear the picture is getting.

Using the space on the next two pages, write a definition of your problem. Write it in two parts:

- **Part 1**—The Big Question! (the question to be answered)
- **Part 2**—The Rules to Follow (important rules that the solution must follow)

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Name: _____ Date: _____

Problem Log 4 Part 1

The Big Question!

Start your definition by writing down the big issue or question that needs to be answered. Use your own words, and be sure this part of the definition begins with words like "How can I . . ." or "What should I . . ." or "Who should I . . ."

The Big Question

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Write on a separate sheet of paper if you need more space.

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Name: _____ Date: _____

Problem Log 4 — Part 2

Pathway: A B C

The Rules to Follow

Directions for Pathway A

Finish your definition by naming one or more rules that must be part of the solution for the solution to work.

Rules to follow: _____

_____

_____

Directions for Pathway B

Finish your definition by naming at least two rules that must be part of the solution for the solution to work.

Rules to follow: _____

_____

_____

Directions for Pathway C

Finish your definition by naming at least two rules that must be part of the solution for the solution to work. But don't stop there! Pretend you are someone else in the problem. Would the new person see the problem the same way that you just defined it? In the space titled "Through another person's eyes," tell why the person you chose might see the problem differently from the way you defined it.

Rules to follow: _____

_____

_____

Through another person's eyes: _____

_____

_____

Write on a separate sheet of paper if you need more space.

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Problem Log 5 Planning Your Internet Search

Always have a plan when you do a serious search on the Internet. In your plan, include:

- The question you want to answer
- The meanings of important, key words in your question
- *Synonyms* for important words (Synonyms are words that mean almost the same as your key words.)
- Search terms that will help your search engine find the information you want on the web

Problem Log 5 has three parts:

- ▶ **Part 1**—What Do I Need to Know?
- ▶ **Part 2**—Doing a Search
- ▶ **Part 3**—Did I Find New Pieces to the Puzzle?

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Name: _____ Date: _____

Problem Log 5 Part 1

What Do I Need to Know?

1. Building a good search plan starts with asking yourself: "What do I need to know?" In the box, write the question that you would like to answer about your problem.

2. Is your question likely to lead you to the information you want?
   - A general question will probably give you lots of information to look through.
   - A specific question tries to give you exactly the information you want.

   Having general and specific questions in mind when you go to the web gives you more of a chance to find what you are looking for.

   Be sure your question is the type you want. To be sure, write your question two more times. First, write it in a very general form. Then write it in a specific form.

A General Form of My Question

_____

A Specific Form of My Question

_____

3. Search engines use your words to search for information. Circle important words in your questions. Think of synonyms (words that mean almost the same as the words you circled). Try using synonyms if your key words don't lead you to the information you want.

What synonyms can I use for important words in my questions?

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Problem Log 5 **Part 2**

Doing a Search

Here are three methods you can use to search for information on the Internet.

METHOD 1

To find all the websites that contain your key word or words anywhere in their material, follow these steps:

- Type a key word or phrase in the search engine's dialog box.
- Click GO or SEARCH.

How did it work?

If you found a reasonable number of sites:

- Scroll through the first 20 to 30 of them. If you can't find useful sites by then, try another word or phrase, another search method, or another search engine.

If your search doesn't find any sites:

- Check for a typing error.
- Use synonyms for the words you used for the first search.
- Start again with a different search engine.

If you have too many sites to look through:

- Search again, using Methods 2 or 3.

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Problem Log 5 **Part 2** *(continued)*

Doing a Search

METHOD 2

To find all the websites that contain your key words near or next to one another in the materials, follow these steps:

- Type the key words in the dialog box, with AND or the symbol + between each of them.
- Click GO or SEARCH.

How did it work?

If you found a reasonable number of relevant sites:

- Scroll through the first 20 or 30 sites. If you can't find useful sites by then, try other words, another search method, or another search engine.

If your search didn't find any sites:

- Check for a typing error.
- Use synonyms for the words you used for the search.
- Start again with a different search engine.

If you have too many sites to look through:

- Search again, using Method 3.

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Problem Log 5 **Part 2** *(continued)*

Doing a Search

METHOD 3

To find all the sites that contain your key words in an exact order, follow these steps:

- Type the key words, in the order you want them found, in the search engine's dialog box. Put quotation marks (". . .") around them. Your words are now called a *search term* or *search phrase.*
- Click GO or SEARCH.

How did it work?

If you found a reasonable number of sites:

- Scroll through the first 20 or 30 sites. If you can't find useful sites by then, try another search or search engine.

If your search didn't find any sites:

- Check for a typing error.
- Use synonyms for the words you used for the search.
- Start again with a different search engine.

If you have too many sites to look through:

- Look back at the other questions you wrote in Part 1. Use key words from those questions as your search terms.
- Ask other people to suggest other forms for your search questions or different key words.

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Problem Log 5 Part 3

Pathway: A B C

Did I Find New Pieces to the Puzzle?

Directions for Pathway A

1. In the websites you discovered, look for relevant, reliable information. Write notes about the information in the New Information box on the next page. On blank puzzle pieces from Problem Log 3, sum up what you find. Add your puzzle pieces to the large puzzle the class started with Problem Log 3.
2. In the Think about Your Thinking box, explain why you trust the information you found enough to share it with your classmates.

Directions for Pathway B

1. In the websites you discovered, look for relevant, reliable information. Write notes about the information in the New Information box on the next page. On blank puzzle pieces from Problem Log 3, sum up what you find. Add your puzzle pieces to the large puzzle the class started with Problem Log 3.
2. Suppose your search found information that said the opposite of what you already know about the problem. In the Think about Your Thinking box, explain how you would decide which information to believe.

Directions for Pathway C

1. In the websites you discovered, look for relevant, reliable information. Write notes about the information in the New Information box on the next page. On blank puzzle pieces from Problem Log 3, sum up what you find. Add your puzzle pieces to the large puzzle the class started with Problem Log 3.
2. Look over the definition of the problem that you wrote when you did Problem Log 4. Based on what you now know, would you change the definition? How would you change it? Or would you leave it as it is? If so, why? Write in the Think about Your Thinking box.

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Name: _____ Date: _____

Problem Log 5

Part 3 *(continued)*

Pathway: A B C

New Information

Write on a separate sheet of paper if you need more space.

Think about Your Thinking

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Write on a separate sheet of paper if you need more space.

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Problem Log 6 How Should the Problem Be Solved?

Real-world problems often can be solved in more than one way. This doesn't mean that all possible solutions are acceptable. It means that good problem solvers, after investigating a problem and using their thinking power, might come up with more than one way to solve the problem.

Problem Log 6 has three parts:

- Part 1—What Are the Possibilities?
- Part 2—Both Good and Bad Things Can Happen
- Part 3—What Is the Best Thing to Do?

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Name: _____ Date: _____

Problem Log 6 Part 1

What Are the Possibilities?

Before you can choose a solution to a problem, you need to know your choices. Brainstorming can help produce a variety of possible solutions.

Brainstorming the Possibilities

Cooperating with classmates, make a list of possible solutions to this problem.

As you make your list, remember two things:

- The possible solutions you come up with need to solve the problem as you defined it. Refresh your memory about the question that your solution must answer. Then look over the special conditions and details that must be considered in your solution.
- During brainstorming, come up with as many ideas as you can. Be creative. Use your imagination. Encourage one another. Build on the ideas of others. Don't criticize someone else's idea.

List of Possible Solutions

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Write on a separate sheet of paper if you need more space.

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Name: _____ Date: _____

Problem Log 6 Part 2

Pathway: A B C

Both Good and Bad Things Can Happen

Solutions to problems almost always lead to good things for some people and bad things for others. The good and bad things are called *consequences*. As a problem solver, your challenge is to know about the good things and bad things before choosing a solution.

One way to think about possible consequences from a solution is to build a decision tree. Look at the Decision Tree that is started on the next page. The problem definition makes up the tree's roots. The trunk is a possible solution to the problem. The branches hold the consequences, good and bad, that come from the solution.

Directions for Pathway A and Pathway B

Select a solution that you think will do the best job of solving the problem. Write your solution on the trunk of the Decision Tree. Write both good and bad consequences among the branches of the tree. Use one side of the tree for good (positive) consequences, and the other side of the tree for bad (negative) consequences.

Directions for Pathway C

Sometimes, consequences themselves cause new problems. Add good and bad consequences to the branches of the Decision Tree. The bad consequences are likely to become problems for someone. Make a list of problems that probably will result from the solution you chose.

Thinking about Your Thinking

What does the idea that each negative consequence is a problem for someone mean to you as a problem solver?

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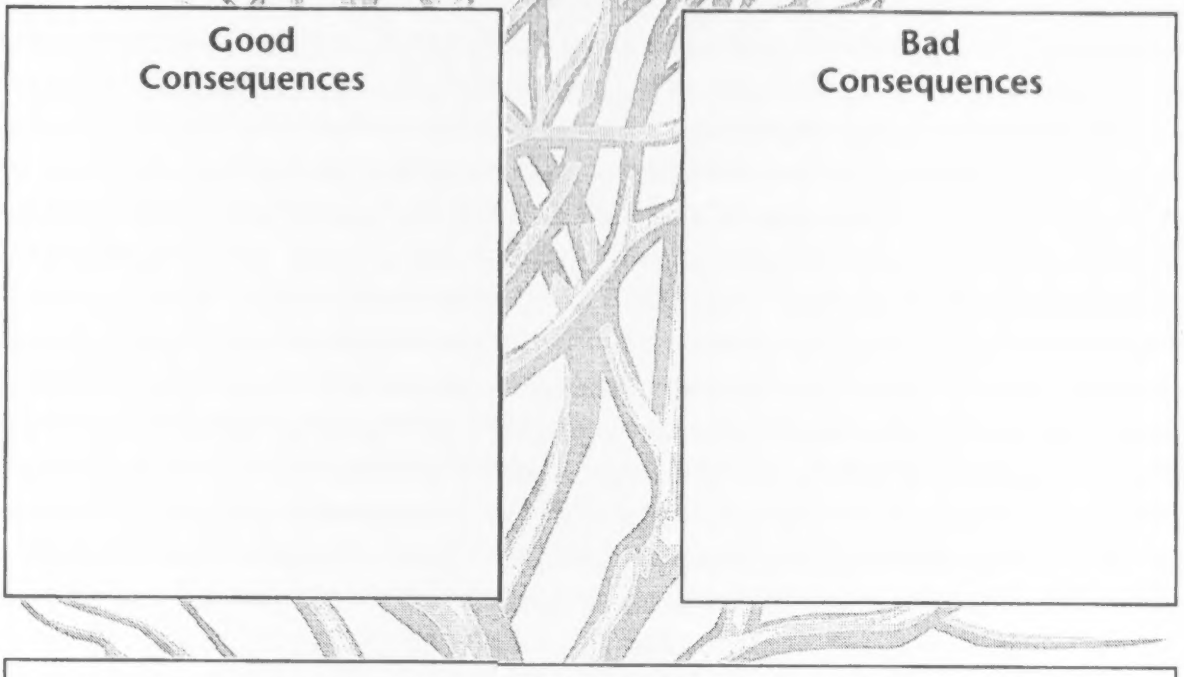
Write on a separate sheet of paper if you need more space.

Name: _____ Date: _____

Problem Log 6 — Part 2 *(continued)*

Pathway: A B C

Decision Tree: Both Good and Bad Things Can Happen



Good Consequences	Bad Consequences

Solution

Definition of the Problem

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Problem Log 6 — Part 3

What Is the Best Thing to Do?

Because both good and bad can come from a solution, you have to be confident your solution is the right thing to do. The right thing to do is the *ethical* thing to do. The words *ethics* and *ethical* refer to the system of moral principles and good choices that people follow in their relationships with others.

To figure out the right thing to do, use the principles and questions below. Keep notes on how you answer the questions. Talk over the questions with others.

Consequences

Doing the right thing means that good things should happen to as many people as possible. Ask yourself:

- Is my solution the best way to make good things happen?

Justice

Doing the right thing means that people should get what they deserve. People doing good deserve good treatment—treatment that's fair and just. Ask yourself:

- Does my solution treat people fairly?
- Does it help them receive what they deserve?

Natural Rights

Doing the right thing means that human beings are to be treated with respect, equality, and dignity simply because they are human beings. Ask yourself:

- Does my solution respect the right of people to be treated with respect, equality, and dignity?

Legal Rights

Doing the right thing means that all people are entitled to the rights and promises granted to them through law. Ask yourself:

- Does my solution make sure everyone gets what he or she is entitled to under the law?

Virtue

Doing the right thing means being honest, kind, courageous, respectful, and using self-control. Ask yourself:

- Is my solution based upon honesty, kindness, courage, respect, and self-control?

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Name: _____ Date: _____

Problem Log 6 — Part 3 *(continued)*

Pathway: A B C

What Is the Best Thing to Do?

In the box, explain how you can apply one (or more) of the five principles to help you decide how much money should be given to each friend who helped you clean up your yard.

What Is the Best Thing to Do?

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Name: _____ Date: _____

Problem Log 7 — Thinking Back

Problem solving can be hard work when done properly. But it can be satisfying, exciting, and fun, too—especially when your solution works.

Think over the problem you just finished. Answer the questions below on your own paper. As you are working, ask yourself:

- What can I do better the next time I meet a problem?

1. Why do you think it's important to do the following items well when working on a problem?
   - Ask yourself: "What do I need to know?" when meeting a problem for the first time.
   - Have a plan to help you find information, especially on the web.
   - Think carefully about the information you are using.
   - Define the problem before trying to solve it.
   - Identify good and bad consequences.
2. Of all the hard work you did to find a solution to your problem:
   - What did you do the best?
   - Which part of the problem was the most difficult for you?
3. Prescriptions written by doctors are directions on what to do to get better. Fill out the prescription below. Give yourself advice on how to be a successful problem solver. When you start another problem, try following your own advice.

Rx

A Prescription for Successful Problem Solving

For _____
(your name)

When working on a problem, remember to:

1.

2.

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Part III

The Problem-Based Learning Units

Unit 1

What's That Strange Creature in the Tree?

Grades 3–4
Focus: Animal Habitats and Human Health

Unit Overview for the Teacher

As animal scientists, the students using this scenario are faced with the problem of how to respond to Colletta Moore's desire to capture a bat in her backyard tree, keep the creature as a pet, and take the bat to school.

Problem Definition

What advice should I give Colletta about the bat, considering the needs and habits of bats and public health risks the bat might represent?

Unit Objectives

Science

Science

Students will:

- Demonstrate knowledge of plant and animal life cycles that include birth, growth, development, reproduction, and death; and know that the details for this life cycle are different for different organisms
- Demonstrate knowledge of plant and animal structures that serve different functions in growth, survival, and reproduction
- Demonstrate knowledge of the interactions between an organism's pattern of behavior and the environment surrounding it
- Demonstrate an understanding of the nature of scientific inquiry

All objectives adapted from: Kendall, John S., and Robert J. Marzano. *Content Knowledge: A Compendium of Standards and Benchmarks for K–12 Education.* Aurora, Colo.: Mid-Continent Regional Educational Laboratory, 1996.

Social Studies

Students will:

- Demonstrate an understanding of the sources, purposes, and functions of law and the importance of the rule of law for the protection of individual rights and the common good

Unique Features of the Investigation

1. Problem Log 1 should feature facts, hunches, and questions about bats, disease, public health rules, school rules, and the responsibilities of pet ownership.
2. Help students to arrive at a definition during session 7 (using Problem Log 4) something like that presented in the Problem Definition on page 91.
3. To examine positive and negative consequences of their solutions, ask the students, "How might your advice influence Colletta's choices? What positive outcomes might evolve from her choices? What negative outcomes might evolve?"
4. The solution product should include advice to Colletta in the form of an e-mail or personal letter by each student, detailing his or her advice to Colletta and the reasons behind the suggestions.

Websites for Problem Log 2

- http://members.aol.com/bats4kids/
- http://www.batcon.org/

Unit 1 Problem Scenario

What's That Strange Creature in the Tree?

Closing the door to your office at the zoo, you notice the e-mail symbol flashing on your computer screen. "I have mail," you say to yourself.

After a couple of mouse clicks, a list of new messages appears on the screen. Two messages are from scientists like you. There is a note from the zoo director reminding everyone about a meeting at three o'clock. Then you see the names, "Colletta Moore" and "King Elementary School."

Subject	Sender Name	E-mail Address
Conference in Hawaii	Jonah Johnson	JJohnson@IslandUniversity
Interesting new results	Neola Singh	NSingh@ResearchCenter
Committee meeting	Anna Bayer	ABayer@Centralzoo
King Elementary School	Colletta Moore	CMoore@KingElementary

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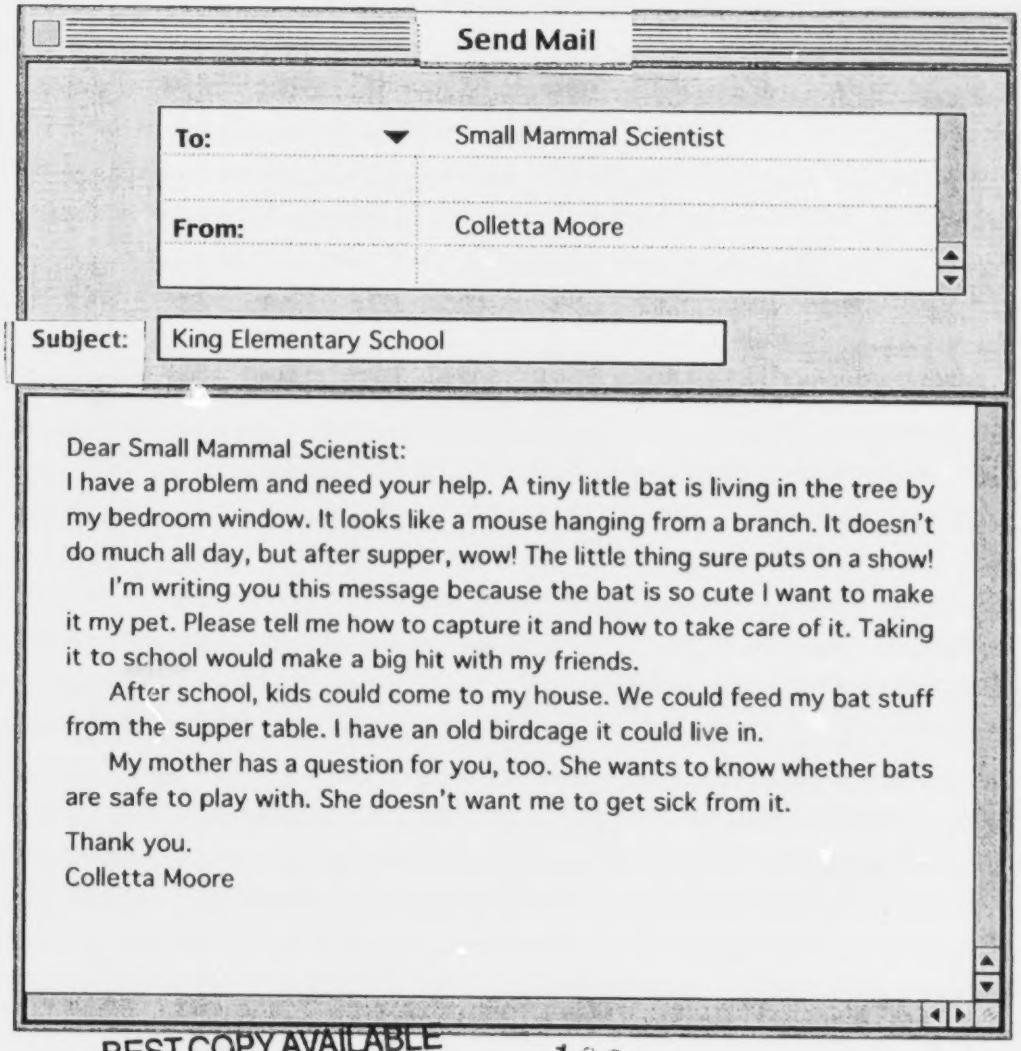
"Hmmm . . . King Elementary School." In your mind, you run down the list of schools where you have spoken. "Oh, yes! King is across the street from the zoo. Maybe Colletta Moore is a teacher, or perhaps she's the principal telling us one of our animals has gotten loose. That would bring some excitement to the neighborhood! Or maybe they want a speaker for one of their classes. It's been a while since I brought my favorite small mammals to a school."

Skipping over the other messages on the screen, you click on "Colletta Moore."

After reading your mail, you think to yourself, "I'd better start on this right now, before Colletta decides to go pet hunting. What advice should I give her?"


Send Mail
To:
Small Mammal Scientist
From:
Colletta Moore
Subject:
King Elementary School
Dear Small Mammal Scientist:
I have a problem and need your help. A tiny little bat is living in the tree by my bedroom window. It looks like a mouse hanging from a branch. It doesn't do much all day, but after supper, wow! The little thing sure puts on a show!
I'm writing you this message because the bat is so cute I want to make it my pet. Please tell me how to capture it and how to take care of it. Taking it to school would make a big hit with my friends.
After school, kids could come to my house. We could feed my bat stuff from the supper table. I have an old birdcage it could live in.
My mother has a question for you, too. She wants to know whether bats are safe to play with. She doesn't want me to get sick from it.
Thank you.
Colletta Moore

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Unit 2

Can the Food Pyramid Help?

Grades 3–4
Focus: Nutrition and Lifestyle

Unit Overview for the Teacher

As dietitians, the students using this scenario must evaluate the dietary needs of two young people and suggest appropriate diets for each.

Problem Definition

What type of diets should Rico and Cheryl follow that will help them solve the problems they are complaining about, reach their lifestyle goals, and live generally healthy lives?

Unit Objectives

Science

Science

Students will:

- Know the availability and effective use of health services, products, and information
- Know environmental and external factors that affect individual health
- Understand essential concepts about nutrition and diet
- Understand the fundamental concepts of growth and development

Mathematics

Mathematics

Students will:

- Understand and apply basic and advanced properties of the concept of numbers

All objectives adapted from: Kendall, John S., and Robert J. Marzano. *Content Knowledge: A Compendium of Standards and Benchmarks for K–12 Education.* Aurora, Colo.: Mid-Continent Regional Educational Laboratory, 1996.

Mathematics

- Use basic and advanced procedures while performing the process of computation
- Understand and apply basic and advanced properties of the concept of measurement

Unique Features of the Investigation

1. Problem Log 1 should feature facts, hunches, and questions about dietitians, nutrition, the food pyramid, and lifestyle and dietary needs.
2. Help students to arrive at a definition during session 7 (using Problem Log 4) something like that presented in the Problem Definition on page 95.
3. The solution product should include an explanation of what Rico and Cheryl will be told during their visits, including an evaluation of their present situation and its dietary implications; and a plan of how to resolve the problems each is bringing to the dietitian.

Students may construct a role play with students from another classroom. Have two visiting students take the parts of Rico and Cheryl so your students can conduct interviews. Coach the role players to act as typical students when it comes to dietary practices. (They can complain about certain foods!)

Websites for Problem Log 2

- http://www.kidshealth.org/kid/stay_healthy/
- http://www.agr.state.nc.us/cyber/kidswrld/nutrition/Pyramid.htm

Unit 2 Problem Scenario

Can the Food Pyramid Help?

On the drive home from the office, you seem to notice each fast-food restaurant along the way. Rico, whom you saw at your last appointment this afternoon, probably knows all of them well. The way he talked about his eating habits, those restaurants are the only places where he ever eats.

The eating habits of Rico and Cheryl, a girl you met earlier today, are important to you. You are a dietitian who helps young people with eating problems or when they want special help with their diets. Cheryl and Rico will be back next week for advice. What are you going to tell them?

"It's time for Rico and Cheryl to meet the food pyramid," you decide. "That's probably the best place to start."

Reaching across to the passenger seat, your hand touches the two students' file folders. You have homework.

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Dietitian's Notes

Name: Rico Clark (Male)
Age: 8 years, 9 months
Height: 52 in. Weight: 105 lbs.

Concern: Always tired, falls asleep in class, much heavier than age mates

Observations: Rico prepares his own breakfast, buys lunch at school, and eats dinner with his family. He admits to snacking all day, bringing chips and cookies to school in his pack, and eating a lot of fast food.

Hobbies: Listening to music, playing electronic games, surfing the Internet, and watching music videos

Favorite foods: French fries, pizza, fried chicken, popcorn, hamburgers, mashed potatoes and gravy

Dietitian's Notes

Name: Cheryl Wozniak (Female)
Age: 10 years, 3 months
Height: 54 in. Weight: 65 lbs.

Concern: Weight and strength gains are slow. Cheryl's sister was a high school star in softball and basketball, and Cheryl wants to follow in her footsteps.

Observations: Cheryl leaves for school at 6:45 each morning. Her bus ride takes an hour. She is an honor student, takes band at school, and has voice and dance lessons in the evenings. She has sports practice each afternoon and on weekends.

Hobbies: No time for hobbies

Favorite foods: Granola and dietary bars, yogurt, fresh vegetables (especially carrots), rice cakes

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Unit 3

What's the Moral of the Story?

Grades 3–4
Focus: Classic and Modern Fables

Unit Overview for the Teacher

As actors and storytellers, the students using this scenario are given the problem of modernizing one of Aesop's fables for use with first and second graders without losing the moral from the original story. The opening situation suggests they find a fable that applies to school rules, modernize it, and develop ideas for props and costumes as a part of the solution product.

Problem Definition

How can I modernize one of Aesop's fables so that the new version can be used with first and second graders, applies to school rules, lends itself to performance by a storyteller, and remains faithful to its original moral?

Unit Objectives

Language Arts

Language Arts

Students will:

- Demonstrate competence in the general skills and strategies of the writing process
- Demonstrate competence in the stylistic and rhetorical aspects of writing
- Write with a command of the grammatical and mechanical conventions of composition

All objectives adapted from: Kendall, John S., and Robert J. Marzano. *Content Knowledge: A Compendium of Standards and Benchmarks for K–12 Education.* Aurora, Colo.: Mid-Continent Regional Educational Laboratory, 1996.

- Effectively gather and use information for research purposes
- Demonstrate competence in the general skills and strategies of the reading process
- Demonstrate a familiarity with selected literary works of enduring quality

Social Studies

Students will:

- Understand basic concepts, values, and responsibilities about civic life

Unique Features of the Investigation

1. Problem Log 1 should feature facts, hunches, and questions about fables, school rules, characteristics of the audience, the nature of values and morals, and the craft of the storyteller.
2. The websites listed for Problem Log 2 can be expanded to include information about civic responsibilities, costume construction, the art of storytelling, stage props, and online resources to aid the writing process. (The search can be expanded to include folktales from Africa, Asia, North and South America, and Australia.)
3. Help students to arrive at a definition during session 7 (using Problem Log 4) something like that presented in the Problem Definition on page 99.
4. During Problem Log 6, have the students explore modern settings for the targeted fables, what they have learned about their audience, how different fables pertain to school rules, and how the different versions might work in the hands of storytellers.
5. To examine positive and negative consequences of their solutions, ask the students to consider how implementing the morals of the fables might change life at school. What would be some positive outcomes? Would anyone face negative outcomes?
6. The solution product should include the text for the modern version, illustrations to accompany the text, sketches of costumes and stage props, and perhaps a videotape of the fable being performed by students in the roles of storytellers.

Websites for Problem Log 2

- http://www.pacificnet.net/~johnr/aesop/index.htm
- http://umass.edu/aesop/open.html

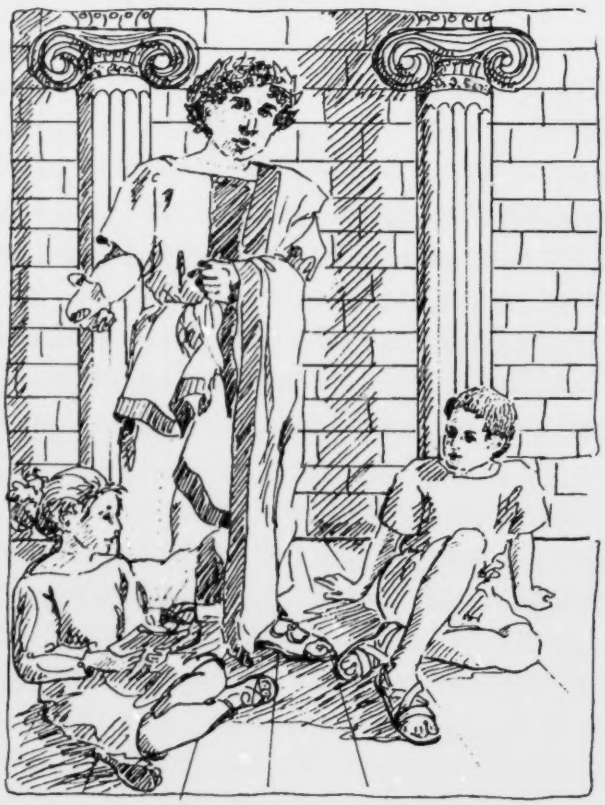
Unit 3 Problem Scenario

What's the Moral of the Story?

You are an actor and storyteller who loves showing students how interesting and fun storytelling can be. You often visit classrooms telling stories based on poetry, plays, and fables. These performances have made you quite well known.

An important fax arrived this morning. The fax contains details about a project you have agreed to do. After reading the message, you say out loud, so you can hear how happy you feel, "This will be a great project to do!"

Now it's time to do some problem solving. Finding a notepad and a pen, you ask yourself, "OK, what are some morals students need to learn? I think old Aesop could help. It's time to visit ancient Greece."



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THE ASSOCIATION FOR MORAL EDUCATION

TO: Project writers
FROM: Ms. Jane Jamison
REGARDING: Preparation of a modern fable
NUMBER OF PAGES: 1

MESSAGE:

Thank you for agreeing to join our project. We want you to write the first story for our new program, Modern Fables. We believe that stories with morals can teach first and second graders important lessons about how to behave at home, in school, and in the community. We think storytelling by teachers and students is a great way to teach, because students have fun while they learn. We suggest you look at Aesop's fables for ideas. Then write a modern version of one of the best stories. Making the story more modern should appeal to today's students. It would be especially helpful if the story's moral would apply to school rules.

We also are looking forward to receiving ideas for the props and costumes that a storyteller could use while performing your story. We would enjoy seeing you perform your story on videotape, if it's possible. Our next committee meeting is in two weeks.

Best wishes!

Jane Jamison

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Unit 4

Does This Jesse Owens Story Belong in Our Magazine?

Grades 3–4
Focus: Writing Skills; Word-Processing Software

Unit Overview for the Teacher

As copy editors for a sports magazine for elementary school students, the students using this scenario are faced with the problem of getting an article ready for publication. A draft has been submitted, but it is filled with grammatical, factual, and mechanical errors, and it is not very interesting.

Problem Definition

What can I do to get this article ready for publication? It has many errors in grammar, writing mechanics, and facts regarding Jesse Owens and his achievements. Also, the writing style is uninteresting. I must remember the ages and interests of the audience members who will read this story.

Unit Objectives

Language Arts

Language Arts

Students will:

- Demonstrate competence in the general skills and strategies of the writing process
- Demonstrate competence in the stylistic and rhetorical aspects of writing

All objectives adapted from: Kendall, John S., and Robert J. Marzano. *Content Knowledge: A Compendium of Standards and Benchmarks for K–12 Education.* Aurora, Colo.: Mid-Continent Regional Educational Laboratory, 1996.

- Write with a command of the grammatical and mechanical conventions of composition
- Effectively gather and use information for research purposes
- Demonstrate competence in the general skills and strategies of the reading process

Social Studies

Students will:

- Understand the values that specific individuals held, and how they had an impact on history
- Understand how individuals used their talents to rise above prejudice and discrimination
- Understand the political setting and propaganda goals of the 1936 Olympic Games

Important note: Before starting this unit, create a disk for students to use that contains a word-processing file of the original article's text (page 106). Using the disk, students can learn more about the editing capabilities of word-processing software.

Unique Features of the Investigation

1. Problem Log 1 should feature facts, hunches, and questions about Jesse Owens' life and athletic accomplishments, racial prejudice and discrimination, the Olympic Games, the readership of the magazine, and specific strategies for improving a written document.
2. Help the students to arrive at a definition during session 7 (using Problem Log 4) something like that presented in the Problem Definition on page 103.
3. During Problem Log 6, have the students explore:
    - The impact their audience will have on how they write their article
    - The level of detail they can use with issues of racial prejudice
    - The focus of the article if it is to be featured in the "Sports Heroes" section of the magazine
    - The potential for positive and negative outcomes from decisions that can be made about the article
4. The solution product should include the edited article ready for publication, an explanation to the managing editor of major changes, and a graphic to include in the magazine.

Websites for Problem Log 2

- http://www.cmgww.com/sports/owens/index.html
- http://www.jesse-owens.org/about1.html

Unit 4 Problem Scenario

Does This Jesse Owens Story Belong in Our Magazine?

"One more story, and this month's issue will be finished!" you say to yourself. You are an editor for the most popular sports magazine read by 8- to 12-year-olds.

When you arrived at work today, a computer disk was on your desk. A note from your boss was attached:

POPULAR SPORTS

MEMO

The story on this disk needs help! I want to use it as this month's "Sports Heroes" feature, but it's poorly written. We don't have much time to fix it. The magazine goes to the printer soon. Get it ready for publication, and don't forget that we have room for only 200 words.

—DJM

"This should be easy," you think, popping the disk into your computer. "If ever there was a sports hero, Jesse Owens was one!"

The story fills the screen. As you read it, your heart sinks. "How could a writer do such a bad job with such a great subject?" you wonder. "Where should I start?"

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Jesse Owens

Jesse owuns was a runner. A jumper two. He set world records. He became a heroe when he went to Germany in 1938. The parents of Jesse Owens named him James but called him JC which caused a problem in school because a teacher could not understand him when he spoke and started calling him jesse. The Owens family moved to ohio. Jesse went to college. He was on the track team. At college Jesse Owens had a great day that would start him toward becoming a sports hero. Before a big race Jesse got a sore back. His coach was worried. He wanted Jesse to rest. Jesse wanted to run. In his first race he ran very well. Then he tried jumping. He won again. He set a record. His coach was happy. Jesse Owens went to the olimpic games. They were held in a country whose leader wanted to show the world that his athlets were the best. Jesse Owns didn't cooperate. Adolph Hitler did not like the fact that Jesse was winning races so he left the stadium very disappointed and even forgot to come back to give Jesse a medal. Jesse Owans died in 1980. People will always remember him.

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Unit 5

Which Countries Will Get Our Help Next Year?

Grades 5–6
Focus: Economic Development of Countries

Unit Overview for the Teacher

As economists at a large foundation, the students using this scenario face the problem of identifying the most needy countries in the world from which five will be selected to receive financial aid from the foundation.

Problem Definition

Which countries should I recommend to receive aid, based on the quality of life in the countries, their political stability, and recent natural catastrophes they have faced?

Unit Objectives

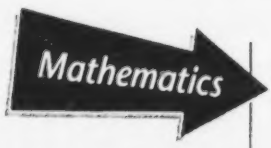
Social Studies

Social Studies

Students will:

- Understand that scarcity of resources requires that countries must make choices. Each choice involves an opportunity cost. (For a definition of opportunity cost, see page 143.
- Understand basic concepts about international economics
- Know the location of places, geographic features, and patterns of the environment
- Understand the physical and human characteristics of place
- Understand the patterns and networks of global economic interdependence
- Understand how physical systems affect human systems

All objectives adapted from: Kendall, John S., and Robert J. Marzano. *Content Knowledge: A Compendium of Standards and Benchmarks for K–12 Education.* Aurora, Colo.: Mid-Continent Regional Educational Laboratory, 1996.



Mathematics

Students will:

- Understand and apply basic and advanced concepts of probability and statistics
- Understand and apply basic and advanced concepts of measurement

Unique Features of the Investigation

1. Problem Log 1 should feature facts, hunches, and questions about poverty, natural resources, technology, trade, quality of life, political stability, natural disasters, and cultural imperatives.
2. Help the students to arrive at a definition during session 7 (using Problem Log 4) something like that presented in the Problem Definition on page 107.
3. To examine positive and negative consequences of their solutions, ask the students to consider how implementing various financial aid plans might change the conditions in the targeted countries. What would be the positive outcomes? Would anyone face negative outcomes?
4. The solution product should include a list of the countries to receive aid and a rationale for extending aid to each place, especially when some needy places will not be receiving aid.

Websites for Problem Log 2

- http://www.cia.gov/cia/publications/factbook/index.html
- http://www.atlapedia.com/index.html

Unit 5 Problem Scenario

Which Countries Will Get Our Help Next Year?

You are an economist for a foundation that helps poor countries recover from natural disasters. A problem has just arrived at your desk. It's in the form of a memo from your boss, the director of the foundation.

The Natural Disaster Recovery Foundation

MEMO
TO: The Chief Economist
FROM: The Director
REGARDING: Who should receive our help next year?

I have just finished looking over figures for next year. The projected loss of funds from contributors leaves us no choice. We must cut back on the number of countries we can help.

Your job is to make a list of the five countries we'll give aid to next year. Those on the list must include places where people face the harshest future. Don't list countries where conditions are so unstable that our aid is likely to be wasted.

Our decision about who is on or off the list should be based upon criteria. Four considerations are listed below. Add your own, but be sure to explain why they are important. I have to present the list to our Board of Directors in two weeks. The countries on the list must:

1. Be among the poorest on our planet
2. Be stable enough for our employees to work in them safely
3. Need help with health care or food production—our specialties
4. Be recovering from a natural disaster that occurred within the past five years or be facing a high risk of future disasters

Putting down the memo, you think to yourself, "Things weren't bad enough for these countries! Now, this has to happen! We can help only five countries next year. OK, who gets our help and who doesn't? It's time to make a list."

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Unit 6

How Am I Going to Survive until I'm Rescued?

Grades 5–6
Focus: Reading and Research Skills

Unit Overview for the Teacher

Cast as the main character, 13-year-old Brian, in Gary Paulsen's book, *Hatchet* (1996), the students in this scenario are given the problem of surviving in the Canadian wilderness after the wreck of a small plane. The students' resources are limited to a few incidental items (the items are listed in chapter 5 of *Hatchet)*, a small hatchet given to Brian by his mother, and the students' own knowledge and skills.

This problem is intended to be used at the close of chapter 5 in Paulsen's book. Tell students that their job is *not* to try to predict what Brian will do in forthcoming chapters, but to come up with their own scientifically defensible survival plans. Even if students read ahead either to find "the right answer" or just because they are interested in Brian's plight, the value of the problem is not diminished. Each student's task is still to construct his or her own knowledge base around survival issues, and transfer what is learned to the present situation.

A special note. An important reason for linking this problem directly to Gary Paulsen's book is to demonstrate how problems described in literary works can be used to construct Problem-Based Learning units. When used with students *during the reading of a text,* the PBL units deepen awareness of the context surrounding the characters and issues. Students can be asked to compare their understanding of elements in the plot with the way the story is told by the author. Important creative and expository writing activities can flow from this comparison.

All objectives adapted from: Kendall, John S., and Robert J. Marzano. *Content Knowledge: A Compendium of Standards and Benchmarks for K–12 Education.* Aurora, Colo.: Mid-Continent Regional Educational Laboratory, 1996.

Problem Definition

How will I survive until rescued, considering my location, the few tools in my possession, and the environment around me?

Unit Objectives

Language Arts

Students will:

- Make choices, based upon appropriate criteria, regarding the usefulness of information discovered during research
- Represent concrete information and abstract concepts or generalizations as explicit mental pictures
- Reflect on what has been learned after reading
- Understand that a single text will elicit a wide variety of responses, each of which is valid from a personal, subjective perspective

Science

Students will:

- Know how species depend on one another and the environment for survival
- Know about the diversity and unity that characterize life

Social Studies

Students will:

- Know the relative location of, size of, and distance between places
- Know the physical characteristics of places and regions
- Understand criteria that give places an identity
- Know plants and animals associated with various vegetation and climatic regions on Earth
- Know how the physical environment affects life in different regions

Health

Students will:

- Know environmental and external factors that affect personal health
- Understand essential concepts about nutrition and diet
- Know how to maintain and promote personal health

Unique Features of the Investigation

1. Problem Log 1 should feature facts, hunches, and questions about characteristics of the physical location, emotional well-being, human survival needs, and survival strategies.
2. Items that make up a survival pack are listed in chapter 19 of Paulsen's book, *Hatchet.* The items become available to Brian after a tornado loosens the pack from the wreckage of the plane and it floats to near the surface of the lake. When you copy the problem scenario for the students, you can cover up the survival item list on page 114, and then distribute the list later in the unit as appropriate. Because the items make survival much easier, they can be introduced early in the unit if the students are having difficulty finding and using survival information; or they may be presented later in the unit (or not used at all) if the students are doing well generating defensible survival plans.
3. Help the students to arrive at a definition during session 7 (using Problem Log 4) something like that presented in the Problem Definition on page 111.
4. The solution product should include a survival plan in the form of two lists: things to do and things to avoid. Drawings and maps can be included in the plan.
5. The opening situation for this unit can be used *without* explicit connection to *Hatchet.* As a problem that illustrates the resiliency of human beings caught in survival situations or as a vehicle for probing science concepts in depth, How Am I Going to Survive until I'm Rescued? can be modified to take students to different sets of learning objectives.

Websites for Problem Log 2

- http://survivalx.searchking.com
- http://www.hikingwithmike.com/

Unit 6 Problem Scenario

How Am I Going to Survive until I'm Rescued?

This morning you were in Hampton, New York. Now you're sitting at the edge of a lake in the Canadian wilderness. In front of you, its tail still sticking out of the water, is the small plane that brought you here.

Your mind is racing wildly, trying to recall anything about survival in the wilderness that you might have heard in the past. One thing is for sure: If you don't get a grip on yourself, you won't survive for long.

"Right now, I'm all I've got," you realize. "I've got to do something."

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Concentrating as hard as you can, you start making a mental list of what you need to do to survive.

You empty your pockets, and the contents make a small pile in front of you. "I have this stuff," you say to yourself, "and the hatchet Mom gave me at the airport is strapped to my belt. I know there's a survival pack somewhere in the plane—but how will I ever get to it?"

Panic tries to take over your mind again. You ask yourself, "How am I going to survive until I'm rescued?"

Items in the Survival Pack Aboard the Airplane

- ✓ A sleeping bag
- ✓ A foam sleeping pad
- ✓ An aluminum cook set, with two butane lighters, in a waterproof bag
- ✓ A sheath knife with a compass in the handle
- ✓ Waterproof matches
- ✓ A first-aid kit containing scissors
- ✓ A cap with the word Cessna printed on it
- ✓ A fishing kit
- ✓ Food packets (waterproof)
- ✓ Bars of soap
- ✓ An emergency transmitter

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Unit 7

What Should Be Done about These Children?

Grades 5–6
Focus: Child Labor

Unit Overview for the Teacher

As legislators on an 1840s commission studying child labor, the students using this scenario are faced with the problem of what to do about child labor in the textile mills. (This problem is designed to be used in conjunction with Katherine Paterson's book, *Lyddie* (1991), which can be a source of the testimony of a mill girl in front of the commission.)

Problem Definition

What should the commission do—if anything—about child labor in the textile mills, considering the existing conditions, the role of child labor in the economy, and the individual stories of the girls working in the mills?

Unit Objectives

Social Studies

Social Studies

Students will:

- Understand how the rise of big business and heavy industry transformed American society
- Understand the rise of the American labor movement and how political issues reflected social and economic changes
- Understand the characteristics of different types of economic systems, economic institutions, and economic incentives

All objectives adapted from: Kendall, John S., and Robert J. Marzano. *Content Knowledge: A Compendium of Standards and Benchmarks for K–12 Education.* Aurora, Colo.: Mid-Continent Regional Educational Laboratory, 1996.

- Understand the role government plays in the United States economy
- Understand how belonging to a social group influences what we feel, say, and do

Language Arts

Students will:

- Demonstrate competence in the stylistic and rhetorical aspects of the writing process
- Demonstrate competence in applying the reading process to different types of texts

To provide students with background on mill working conditions, use Paterson's *Lyddie* or another source. You can provide students with the "testimony" featured in the scenario on pages 117–8 by reading aloud from the relevant sections of *Lyddie*.

Unique Features of the Investigation

1. Problem Log 1 should feature facts, hunches, and questions about the work environment for children in the mills, the impact of industrialization on family life, the incentives to use child labor, and the diverse life situations that brought children to the mills.
2. The websites used for Problem Log 2 can be increased to include sites describing working conditions in English mills, which are well documented on the Web. These conditions can be used for comparison to those in American factories.
3. Help the students to arrive at a definition during session 7 (using Problem Log 4) something like that presented in the Problem Definition on page 115.
4. During the solution building of Problem Log 6, encourage students to include outcomes from the restriction of child labor that will have negative effects on children, especially children who sought refugee in the mills because they were orphaned or abused.
5. The solution product should include a draft of legislation or recommendations to the commission by each member, with their rationale for the proposed action.

Websites for Problem Log 2

- http://www.kentlaw.edu/ilhs/lowell.html
- http://www.history.ohio-state.edu/projects/childlabor/ (Click on "The Story of My Cotton Dress")

Unit 7 Problem Scenario

What Should Be Done about These Children?

The large meeting room is filled with people. In the center of the crowd are twelve girls from Lowell, Massachusetts. They are here to testify about working conditions in the textile mills. "Gutsy girls!" you think to yourself, taking a seat with the other committee members.

The Special Committee to Investigate Child Labor is looking into working conditions in factories in Massachusetts. You and the other members of the committee are trying to decide whether anything should be done about those conditions. You are especially interested in finding out the effect that the textile mills are having on the children working in them, especially these girls.

The chairman's gavel falls, and he asks, "Will the first witness take her seat?"

A young girl, Lydia Worthen, takes a seat in front of the committee.

"OK, young lady. Tell us your story."

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As Lydia begins to describe the difficulties of working in the mills, the committee member on your right passes you a note. It reads:

Is she telling us the truth? Some people say these girls are making up this whole story. They want higher pay from the owners. Shouldn't they be happy to have a roof over their heads and good meals every day?

I've seen their boardinghouses, and I've met some of the overseers. They seem to have the children's well-being at heart.

I think the unions are putting them up to this. The children are just paupers anyway, or else they ran away from some dreadful farm out in the country. The price of American textiles is too high now to compete with England's prices. Better conditions would drive prices even higher. Working conditions here are many times better than those for English children, I've been told.

~ JCR ~

The committee member raises important issues. What do you think of his argument? What—if anything—should be done with these children?

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Unit 8

Who Else Should Be Invited to Join the League?

Grades 5–6
Focus: Geographic Location and Relationships

Unit Overview for the Teacher

As executives with a new women's professional soccer league, the students using this scenario are faced with the problem of recommending the last three teams from a list of candidates to complete the lineup for the first year of competition.

Problem Definition

Which teams should be selected to complete the league's membership, considering the distance teams must travel for games, the goal to build regional rivalries, the population of candidate cities, and other criteria that seem important?

Unit Objectives

Social Studies

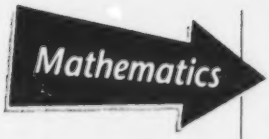
Students will:

- Understand the physical and human characteristics of place
- Understand the concept of regions
- Understand the concept of prices and the interaction of supply and demand in a market economy

Characteristics of place:
The natural and man-made features of a location that make it special, unique, and different from other locations.

Social Studies

All objectives adapted from: Kendall, John S., and Robert J. Marzano. *Content Knowledge: A Compendium of Standards and Benchmarks for K–12 Education.* Aurora, Colo.: Mid-Continent Regional Educational Laboratory, 1996.



Mathematics

Students will:

- Understand and apply basic and advanced properties of the concept of measurement
- Understand and apply basic and advanced properties of the concept of numbers

Unique Features of the Investigation

1. Problem Log 1 should feature facts, hunches, and questions about the nature of regional rivalries, a future league with two divisions, the role of air travel in the expenses of a team, and competition for the attention of fans in cities with different populations and athletic attractions.
2. Help the students to arrive at a definition during session 7 (using Problem Log 4) something like that presented in the Problem Definition on page 119.
3. During Problem Log 6, include positive and negative outcomes for competing cities, team revenues, and the lifestyles of the players who probably will be living in the cities.
4. The solution product should include a list of recommendations with a rationale for each choice. Rationales can include graphic displays of information from which comparisons can be made. Commercial air travel passenger rates might be used to compare the cost of travel between cities. Maps also might be produced to illustrate the cities and their metropolitan regions as an aid to understanding areas from which potential fans might be drawn.

Websites for Problem Log 2

- http://coolmath4kids.com/calculators/airport.html
- http://www.census.gov

Unit 8 Problem Scenario

Who Else Should Be Invited to Join the League?

Last night, a party was held to celebrated Chicago's selection as the fifth team in the Women's Professional Soccer Alliance (commonly called "the Alliance"). A new league was born!

The new birth also satisfied a cable television company. Now they will broadcast the league's games and share their revenues with the Alliance.

As assistant to the president of the Alliance, you have the problem of recommending the last three teams to join the league for its first season.

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Opening a file on your desk, you take out a letter stating the criteria for making your choices. You think about the five teams that already are in the Alliance, and you ask yourself the big question, "Who else should be invited to join the league?"

The Women's Professional Soccer Alliance

Final Eight Teams

Teams (by city) asking to join the Alliance:

Atlanta	Jacksonville	Raleigh
Boston	Mexico City	San Antonio (selected)
Chicago (selected)	Milwaukee	San Diego (selected)
Dallas	New York (selected)	San Francisco
Detroit	Philadelphia (selected)	Seattle
Indianapolis	Phoenix	Washington D.C.

Criteria for selection of cities to complete an eight-team league by the end of next year (not listed in order of priority):

- Create rivalries based upon geographic locations.
- Break the league into two divisions of four teams each. Keep distance between cities as short as possible to minimize air travel.
- Be sure each team has a large enough population from which to draw fans.
- Use any other criteria that will help the team (and, therefore, the league) to be successful.

The season will begin in April and end with playoffs in August. Each team will play 20 games. Games will be played on Saturdays or Sundays.

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How to Create Your Own Units

After using the problems in this book, you may want to construct your own PBL units. Start with short, simple problems. Increase their complexity as your PBL experience increases. You may need to design a unit or two before you become comfortable with the process, but be assured that the learning curve is steep.

Step 1: Find an Inspiration

Creating a unit begins with finding an inspiration. Some designers work forward, starting from an objective or goal, and construct a problem that features the targeted objectives. Others work backward, beginning with an actual ill-structured problem or event. Regardless of the direction in which you work, an inspiration provides the guidance or actual model for a unit. Begin searching for an inspiration by looking for a contemporary or historical:

- Decision to be made or that was made (Example: Which city or country should host a forthcoming Olympics?)
- Dilemma to be resolved or that was resolved (Example: Should schools remove snack machines or allow companies to advertise in their buildings?)
- Process or concept to be understood (Example: How does a business choose a new location for a plant or outlet?)
- Controversy to be resolved or that was resolved (Example: a recent court decision on an aspect of the First Amendment's influence on the lives of children, such as censoring music lyrics or the content of television programs)
- Product to be designed or redesigned (Example: unsafe children's toys)
- Mystery to be explained or one that was solved (Example: diminishing numbers of an animal species)

- Artistic production to be created (Example: a monument or memorial for a famous person or event)
- Problem to be solved or one that was solved (Example: raising and lowering ships along the canal route in Panama)

Inspirations can appear almost any time but are especially plentiful in:

- Newspapers (news articles, editorials, and advertisements)
- Television and radio features (especially programming on public television and radio)
- Themes and situations from literature and the movies (for example, a character's problem)
- Textbook accounts and collections (almost any page from a textbook)
- Previously taught units (redesigned to feature its problem)
- Journal articles, community issues, and personal experiences

Especially fruitful searches can be made on the web using Problem-Based Learning as the search phrase. Be sure to conduct the search using more than one search engine so that the contents of many engine directories are examined.

Step 2: Create a Stakeholder and Situation for the Unit

PBL units open with students meeting a situation in which they have a role or stake. Carefully build the opening scenario so that it leads students to the objectives you want to accomplish. Design opening scenarios to:

- Be engaging for the students
- Contain just enough information and clues to launch the process of inquiry in the direction you want it to go
- Provide an authentic context for the students. Be sure everything in the scenario has the look and feel of a real-life situation.

Review the situations that open each of the problems in this book. What features make the situations engaging for students? What clues are provided in the text that will alert students to the important issues and questions? What types of authority, responsibility, and power does the stakeholder role give to the students? Why is the authority and power that is bestowed upon them important for their investigation? What features in the situation seem to make the problem concrete enough, and in other ways appropriate, for the intended student population?

As you design your PBL unit, answer these questions about your own scenario. Don't be surprised if creating an opening scenario takes some time, especially in the number of rewrites you do. The scenarios will be even better after they have been used with a group once and then edited.

Step 3: Brainstorm the Content in the Problem

The purpose of Problem-Based Learning is to simultaneously broaden students' knowledge bases and develop their problem-solving abilities. The scenario therefore must contain an ill-structured problem that will be a good context for practicing inquiry skills and provide just the right number and type of cues and clues so the students will encounter specific content as they conduct their inquiry.

Before proceeding with your design, get a sense of the content your problem will bring to your students and the opportunity it will offer for problem solving. Brainstorm both of these possibilities by building a content map around the ill-structured problem your students are likely to meet, based upon your inspiration and captured in the opening situation or scenario you are drafting.

To build a content map, start with a sheet of newsprint. In a circle in the middle of the paper, write a tentative title for your situation. (See Example of a Content Map on the next page.) Then identify the big ideas or major chunks of knowledge (concepts) that form the knowledge base needed to understand the problem. Enter each concept, idea, or theme in a series of small, separate circles, and arrange them in a ring around the circle in the center of the page. Each of these labeled circles is then connected to the center circle with a line. From each of the satellite circles spring concepts or knowledge chunks that make up its composition. Put these labels in small circles, and connect them to their host circles.

Continue the process of identifying smaller and smaller concepts or bodies of knowledge and attaching them to their parent thought, until you are satisfied that you have a composite of the ideas and skills that can be highlighted in your unit.

When you have completed your content map, ask yourself four questions:

1. Is the content on this diagram significant?
2. Does the content, including skills, fit my curriculum responsibilities?
3. Is the content appropriate for my students? (This involves the complexity of the content as well as the possibility of controversy.)
4. Does it seem likely that a PBL unit can emerge that will fit the time I plan to use for the unit?

If you are satisfied with your answers to these questions, complete the opening scenario for your PBL unit.

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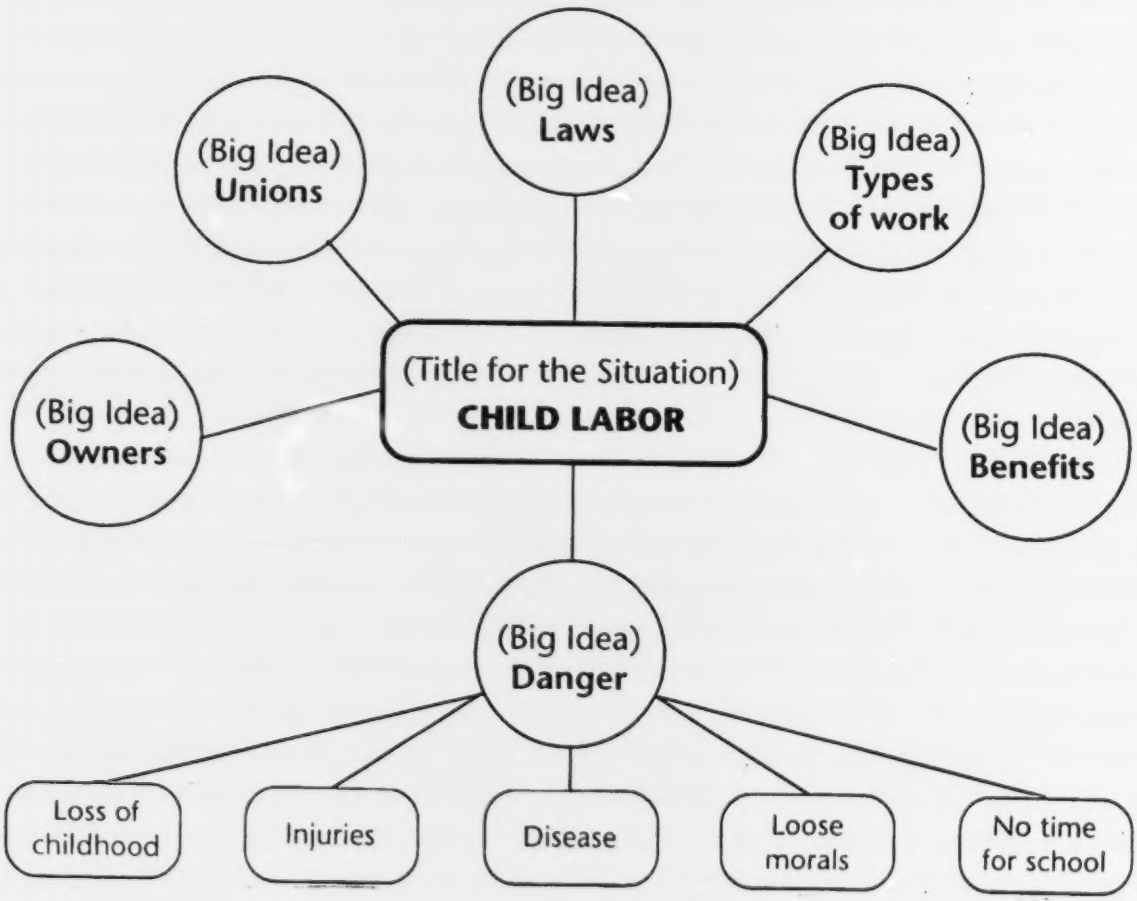
Example of a Content Map

Unit 7: What Should Be Done about These Children?



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Step 4: Design the Coaching Plan

The Coaching Plan Design Template asks you to specify:

- How the class sessions will be used during the unit
- The big ideas and essential questions that will be emphasized during each session
- The resources that will be needed for each session
- Ideas for authentic assessments that can be assembled into a portfolio to mark each student's progress

Coaching Plan Design Template

Session-to-Session Narrative	Big Ideas and Essential Questions	Resources	Authentic Assessments

To get the most out of the situation you have created, you need a plan. To guide you in developing a coaching plan for your unit, use a form with four columns, as above. Label the top of the first column Session-to-Session Narrative. In this column, describe the action that will take place in the classroom as the several sessions in the unit unfold. Describe the types of student groupings you will use, the materials you will distribute, and when embedded instruction might take place. This column will give you an idea of how long a time period the unit will take to unfold. PBL units have yeast in them: When they get started, they are more likely to get longer than shorter; so be concerned when the number of sessions in this column becomes excessive. To tighten the length of a unit, reduce the complexity of the problem; or provide a little more information and require less searching on the part of the students.

The second column of the coaching plan is titled Big Ideas and Essential Questions. Its entries run alongside the descriptions in the first column. In this second column, enter important concepts and generalizations to focus on during discussion, and list essential

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questions you want your students to understand. Consider the questions shown in the coaching plans on pages 27–44. A number of them might fit well with your problem.

The third column, Resources, specifies what is needed for each session. The resources can include Internet sites and print materials you plan to use along the way. List topics for embedded instruction in this column. If you plan to use graphic organizers during discussions or to organize information from Internet searches, describe them here.

The fourth column, Authentic Assessments, is extremely important. As you describe the activity for each session, record ideas for authentic assessments—tasks that have the look and feel of real life. By definition, they exclude typical quizzes and tests. The activities for the units in this book are examples of authentic assessment tasks. Each mirrors the activity of a professional problem solver.

To use authentic assessments effectively, rubrics need to be constructed that specify the criteria that will be applied to each task. The criteria are arranged in categories, and the categories mark the performance level that each criterion represents.

See pages 48–55 for a Master Rubric with performance standards that can be used to assess each of the Problem Logs.

Checklist for Preparing a PBL Unit

- ❑ Be realistic—don't try to pack everything from a traditional unit into one problem.
- ❑ Find an inspiration for your unit, and use it as your model.
- ❑ Create an opening scenario for your unit. Give careful attention to the situation and stakeholder role your students will use as the context for their problem.
  - An effective situation contains just enough clues and cues to initiate fruitful inquiry.
  - Be sure that everything in the scenario has the look and feel of an authentic situation.
- ❑ Brainstorm the potential content in your inspiration before investing too much time in its development.
- ❑ Build a content map in which you break major topics into smaller and smaller units of content.
- ❑ Construct a coaching plan that describes the details and resources that will turn your idea for a unit into a reality.
- ❑ Tighten the length of the unit to fit a reasonable window of time.

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Appendix 1

Basic Procedures for Searching the Web

The Internet is so many things to so many people that it's hard to describe the system beyond its most sterile characteristic: a vast, worldwide collection of linked computers. They are connected by simple telephone lines and complicated cables, and by transmissions between satellites and the Earth. The reason they are connected into a network is to allow people to share information.

The World Wide Web is a special part of the Internet. Through the Web we have access to printed information, pictures, video, sound, and computer animation stored on host computers all over the planet.

The basic technology behind the World Wide Web is hypertext. Hypertext is a way to present information so that when a word or icon on the screen is selected, the computer automatically links to more information about a topic. This other information could be music, animation, text, programs, and other websites.

By using a search engine, Internet users can request access to information stored almost anywhere on the Web. Search engines look for information on the Internet at blinding speed once you give them a word or phrase to tell them what you're interested in. But none of the software programs has solved the problem of finding exactly what you want. Learning to successfully navigate the Internet, and then use the information discovered for productive problem solving, are important skills for students to master.

See glossary, starting on page 140, for definitions of unfamiliar terms.

Finding Information on the Web

The basic procedure to reach a website is to:

1. Turn on the computer.
2. Log on to the school's system, if necessary.

3. Provide your password, if necessary.
4. Find the icon for the web browser. Click on the browser's icon.
    - Using the search engine provided by the browser, type the desired URL in its dialog box; or
    - Examine the menu of search engines available with the browser and click on your choice.
5. Type a search term in the engine's dialog box.
6. Click on the GO or SEARCH space next to the dialog box.
7. Wait for the search engine to find the site and show it on the computer screen.

A browser is a software program that connects a computer to the web.

In this book, it is assumed that the computers your students will be using have been organized into a network, and someone has selected a browser that will provide access to the Internet in your school.

Determine which web browser is being provided. In all likelihood, the browser will be either Netscape Navigator (now known as Communicator) or Internet Explorer. When you log on to a computer in your school, a small icon representing a browser will appear on the screen. To begin, just double-click on the icon.

When you click on the icon for your web browser, one of two things will happen:

- Your browser will select a search engine for you, because it was programmed to make this selection when it was originally installed on your school's computers
- It will give you a list of search engines that you can choose from.

If you want to use a search engine that is not on the browser's list, simply type the URL for the search engine in the browser's dialog box and click on GO or SEARCH.

Selecting a Search Engine

There are hundreds of search engines, and no single search engine does a completely satisfactory job for all uses. Even the best search engine will find only about 20% of the material available on a topic during an Internet search.

The suggestion to use just a few search engines doesn't mean your students won't benefit from using more engines in the future. It's just a way to "keep it simple" until they become competent with the basics of searching the Internet. Later, encourage them to try other engines and develop their own preferences.

Selected Search Engines

Popular search engines for use with the PBL units in this book include:

- **Yahooligans:** http://www.yahooligans.com
  Lists sites for children selected by the staff at Yahoo; organizes sites by subject categories
- **Ask Jeeves for Kids:** http://www.ajkids.com
  Searches are based on questions asked; screens out most material that is inappropriate for children
- **KidsClick:** http://sunsite.berkeley.edu/KidsClick!/
  Librarian-selected sites for children
- **Awesome Library:** http://www.awesomelibrary.org
  Contains resources reviewed for use by children
- **Search Tools:** http://rcls.org/search.htm
  Contains a variety of search engines and other tools all on one page
- **Fact Monster:** http://factmonster.com
  By the publishers of *Infoplease for Kids Almanac*

To access reviews, tutorials, and recommendations about these and other search engines, visit **Search Engine Watch:** http://www.searchenginewatch.com

Using Links to Extend a Search

Each website provided in this book gives you access to information at that site and also links you to other sites with information on the same topic or issue. Using links, it is possible to move from website to website without entering another URL.

To find links at a website, locate words or phrases highlighted in blue (or another color) and underlined. Also look for a list of color-highlighted, underlined words or phrases that have been grouped together under a title containing the word *links*. To access these links, move the mouse arrow to any one of them, wait for the arrow to turn into a pointing finger, and then click.

If a message appears on your computer screen telling you the link CANNOT BE FOUND or ACCESS DENIED, click on BACK at the top of your screen. The screen will return to where you were before you clicked on the link.

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Planning and Executing an Independent Search

There will be times when students need information and no one is available to give them sites to work with. They need to be competent in planning and conducting their own web searches. The strategies below are the basic building blocks for productive searching.

Strategy #1. Plan Your Search

The chances of finding what you want on the Internet are always increased by planning before you begin the search. Problem Log 5 leads students through the process of planning an independent search on the web. In general, a useful plan results from following these steps:

1. Create a question that clearly states what you want to find. Review your question. Does it ask for exactly what you want to know? If not, write the question again.
2. Be sure you understand the terms and ideas in your question. Underline important terms or ideas. Use a dictionary or encyclopedia (there are good ones online, such as www.factmonster.com) to learn more about terms you don't understand completely. Use a dictionary to be sure search words are spelled correctly.
3. Make a list of synonyms or variations for the important words in the question you are investigating. Because you can't be sure the terms in the question are exactly the terms the search engine will use for its search of the Web, be prepared to use alternative words. An online thesaurus, such as the one available at Merriam-Webster Online (www.merriamwebster.com), can be very valuable for this step.
4. Combine your key words with other words to make phrases that describe your question in more detail. Type one of these search phrases into the dialog box, and click. If the search is not productive, create new search phrases using synonyms and variations for your original terms.

Strategy #2. Find Sounds, Pictures, or Photographs

Some search engines allow you to search specifically for sounds, illustrations, or photographs. Look in the search engine's HELP section for instructions on how to do this.

To explore online collections of pictures and photos, go to these sites:

- Lycos Multimedia: http://multimedia.lycos.com
- Alta Vista Image Search: http://www.altavista.com/sites/search/simage

If you want to search for photos or pictures on the web, type gif or jpeg after your search word. Although this strategy can be used only when searching by single words, you'll be amazed at the number of photos and pictures you can find on the Web.

Strategy #3. Use Simple Words and Marks That Make Your Computer Work Smarter

There are a number of ways to make your computer work smarter, in particular, using Boolean search commands: the words AND, OR, AND NOT, quotation marks, and plus and minus signs.

▶ Using AND

Using AND helps to narrow a search. When AND is typed (in all upper-case letters) between two words, it tells the computer that you want only sites that include both the first and second words.

Example: Suppose you want to find sites about American presidents to determine the qualities of outstanding presidents in American history. Typing the words "American" and "presidents" into the dialog box tells the search engine to look for sites that have the words American and presidents in their files. The search would give you sites containing just the word American, and sites containing just the word president or presidents. It also will give you sites with both American and presidents in them, but the terms could be separated by other words, sentences, or even pages. If you want to narrow your search to only sites that have both words in them, type your search terms like this:

American AND presidents

Now the results of the search will include only sites where both words appear.

▶ Using a Plus Sign

Another way to get the same results from your search is to use the plus sign in place of AND. Then your search terms would be typed into the dialog box like this:

+American +presidents

Notice that a plus sign is also added to the first word, so there is no doubt the search engine also will include it.

▶ Using Quotation Marks

Enclosing words in quotation marks narrows your search even more. It tells the search engine to find only sites where the words appear in exactly the same order as they do inside the marks.

gif
(Graphic Interchange Format): A common format for images stored in files that can be accessed through Internet searches

jpeg
(Joint Photographic Experts Group): A format for storing images that is especially popular for use with photographs

Example: To be more precise in your search for sites about American presidents, type the search terms like this:

"American presidents"

When this is typed in the dialog box, the search engine is being told to find sites where American and presidents appear next to one another, in that exact order.

For more detailed explanations for the use of OR and the other Boolean search commands discussed here, see sites that detail search strategies. They can be found by using the search term "Boolean logic".

▶ Using OR

Typing OR between the terms you are looking for tells the search engine to find sites that include any and all of the keywords.

Example: Suppose you wanted to explore ideas about a possible pet for your family. Both dogs and cats have been mentioned in family discussions. Your search could begin by typing in terms connected with OR like this:

dogs OR cats

This search will return websites about either dogs or cats and both dogs and cats.

OR is most often used to link synonyms together so that a search will look for any of the synonyms and another key word.

▶ Using AND NOT

Using AND NOT narrows the results of a search. It tells the search engine to disregard or exclude something from the websites it is finding.

Example: Suppose you are using "American presidents" as your search phrase, and you want to find sites about presidents other than Abraham Lincoln. You would search using: "American presidents" AND NOT Lincoln

This search will give you sites that include the term *American presidents*, but not sites that mention Abraham Lincoln.

▶ Using a Minus Sign

Another way to get the same results from your search is to use the minus sign in place of AND NOT. Type your search phrase and term into the dialog box like this:

"American presidents"–Lincoln

Strategy #4. Using a Search Engine's Own Directory of Topics

Most search engines come with their own selection of websites organized around popular topics. This directory usually is on the search engine's home page, in colored text and underlined. The topics in these directories usually include items that the general public often looks for, such as travel, sports, weather, finance, and automobiles. Urge students to look in these directories as well as construct independent searches.

Highlighted text usually indicates a link to additional information.

Advanced Search Techniques

Each search engine contains a HELP section that describes techniques for productively searching the Internet. Usually this is reached by clicking HELP or an icon on its home page.

It is not necessary to rush children into advanced forms of searching. It is more important to provide time for plenty of practice so they gain confidence in the search basics.

Appendix 2

Using Information from the Web

Information gathered from the World Wide Web is important for problem solving because it is the raw material from which deeper understanding, valid conclusions, and appropriate solutions are fashioned.

Teach students to ask themselves two important questions before they accept and use information from the web or any other source:

- How is the information relevant (useful) to the question under investigation?
- How do I know the information is reliable (trustworthy)?

Because information is interesting or includes one of our search terms doesn't make it relevant. Students need to develop an eye for relevance and the discipline to avoid using their scarce time on topics that are not useful for their inquiry. Similarly, they need to recognize that anyone can post information on the Internet, and that one of their responsibilities as problem solvers is to determine whether information can be trusted.

To help them with this daunting task, we can train them to look for signs that information on a particular site should be used with caution. Those signs might include:

- The length of time a site has been on the Internet without updating its information
- The use of extremely strong language in support of an idea
- The exclusion of information about ideas that differ from those on the site

Teach students to identify the author or owner of each site and decide whether that person has the authority to speak about the subject. This will automatically lead to discussion of concepts like bias, perspective, and balance—critical understandings for a student who is on the journey from novice to expert problem solver.

Appendix 3

Using the Internet Responsibly

As teachers, we must be sure that students learn to respect the Internet's vast online resources and learn how to use them effectively within a secure environment.

Although governments, businesses, and organizations support and use the Internet, they do not control it. The Internet is a remarkable example of individual responsibility. Those who use it are expected to behave civilly, respect the property and privacy of others, and contribute to the Internet community when they can. The fact that the Internet is based on cooperative behavior and managed by the people who use it means that it is changing all the time.

It is important to remember that somebody wrote every item on the Internet. Often the authors have property rights to what they wrote, and many items are covered by copyright laws. In most cases it is appropriate for a teacher or student to download material for use in his or her class or project. But generally it is not appropriate for a teacher or student to download a file and send it on the Internet to others unless the author or copyright holder of the original material has given permission. Students must be taught to consider these questions: "Who owns this material? How is it going to be used? Is this the way the author or owner intended it to be used?" If it is going to be used in a way the author did not anticipate or intend, permission to reprint the material must be requested from the author or copyright holder. Regardless of how the material will be used, its source and authorship must always be cited.

What Is Acceptable and What Is Not?

There are rules about acceptable use of the Internet. In general, they authorize educators and schools to use Internet resources for research and instruction. They do not permit any activity that:

- Tries to gain access to resources for which the user is not authorized
- Disrupts the use of the Internet
- Wastes people's resources or diminishes the capability or integrity of the network
- Destroys the integrity of computer-based information
- Compromises the privacy of the user

Security

Making resources and the user secure is an important problem. Security breaks down into two issues:

- Security of the whole system
- Security of the user's own computer and privacy

Unfortunately, an open system attracts criminals and hackers whose aims are to destroy and steal. More than one hacker has tried to destroy the system by introducing "worms" and viruses.

There are several things that teachers, students, and those in charge of a school's computers can do to keep the Internet secure.

- Every user should understand the security policies and procedures of his or her own computer and network site.
- Follow the procedure for protecting the identity of passwords. Do not allow students to let others use their system or network passwords for personal work or enjoyment.
- Do not share access to resources assigned to you. Help others receive the access they desire through regular school procedures.
- Never leave a computer on a network logged in and unattended. Be sure the computer lab is secure after a class has used it.
- Do not let your students use their personal disks on school computers (especially networked computers) or allow them to download programs or files from unfamiliar Internet sites. Viruses spread easily if you let your guard down.
- If a computer in your classroom is equipped with an Internet connection and anti-virus software, find out how often you or someone else is responsible for upgrading the software. Be sure the schedule is followed.

A Word of Caution

The Internet offers access to human resources on the same order of magnitude that it offers access to information files. But caution must be practiced when exposing students to these resources.

- Pay close attention to where students wander while navigating the web. The Internet is an open system. Pornography and hate literature are easily accessible. Extremists of all kinds propagandize, and there is no control over the quality of posted material.
- Allow students to e-mail experts directly only if you know the person and/or organization and are sure of the students' safety. Even though e-mail is usually the most secure way to contact human resources, there are too many cases of children being harassed by people they meet over the Internet. Before you allow any outgoing e-mail to an unknown person or organization over a computer at school, send an introductory message to the person yourself, using an e-mail account provided by your school. Ask the person if he or she is willing to communicate with your student, and ask for a phone number by which you can verify the person's identity.
- It is generally felt that students should not join news or chat groups on school time or without express parental permission. It is even more prudent simply not to allow your students to participate in either Internet service. Predators routinely read public conversations looking for easy targets; and chat rooms are tremendous consumers of students' valuable time.

Glossary

Terms Related to the Computer

Address. A unique set of letters and numbers that specifies the location of a person, machine, or data on the Internet.

Backup. An extra copy of material that is stored apart from the original material in case it is lost or damaged. Back up your work often.

Bookmarks. Lists of frequently selected web addresses. Web browsers allow users to create bookmarks so they can return to favorite sites easily. Sometimes called Hotlists or Favorite Places.

Boolean Logic. A strategy that uses AND, NOT, OR, and other words and symbols to refine an Internet search. See pages 133–4.

Browser. Software to find and retrieve information on the Internet. Web browsers are programs that are used to access the World Wide Web and allow a person to read hypertext. The browser gives some means of viewing the contents of web pages and of navigating from one website to another.

Directory. A list of files.

Download. Refers to the transfer of a file to the user's computer from some other computer. The opposite of upload, which sends a file from the user's computer to another computer. Both terms refer to the movement of files between computers.

File. The name under which computer programs, documents, or other software applications are stored. There are two main kinds: data files and program files. Program files are those that control how the computer operates. Data files contain information of various kinds but do not instruct the computer.

gif. Abbreviation for Graphic Interchange Format, a common format for images stored in files that can be accessed through Internet searches.

Homepage. The first thing that appears on the monitor when a user accesses a World Wide Web site. It is the "table of contents" to the website.

http. An abbreviation for Hyper Text Transport Protocol. The set of rules that programs must follow for web users to communicate with servers and transmit information back and forth. As the first instruction in an address to the World Wide Web, it is always in lower case (http://).

Hyperlink. A colored or highlighted (often underlined) word or picture on a web page. When it is selected, it takes the user to a related piece of information.

Icon. A symbol used to represent a person, place, or idea. In computer programs, used to speed up and improve communication.

Internet. A worldwide collection of computers that are interconnected in such a way that they can communicate with each other. The computers have hardware and software that provide access to the databases they contain.

jpeg. Abbreviation for Joint Photographic Experts Group, a format for storing images that is especially popular for use with photographs.

Keyword. A word (or words) used to search for documents or menus.

Links. Electronic connectors to other places on the site or on the Internet that have topics like those at the site currently being visited.

Menu. A list that provides information about features of a program or at a site.

Menu bar. A row of icons that represent menus available on the computer that is being used.

Program. Software that controls the operation of a computer; a series of instructions to the computer that tells the computer what to do. See File.

Search engine. A software program that enables the examination of large databases for selected words or phrases; a program that allows for keyword searching of online information. There are hundreds of search engines of different types.

Site. A computer connected to the Internet; a host that allows remote access.

World Wide Web. Abbreviated WWW or www. A part of the Internet that can accommodate a wide range of materials. It allows the use of text, hypertext, graphics, video clips, and sound. Though the terms are often used interchangeably, the WWW is only one part of the Internet.

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URL. An abbreviation for Universal Resource Locator. The address of any resource on the World Wide Web. It is a standard format which contains information about what kind of computer to be contacted, the path to access it, and the method of communicating with it. It is sometimes used as a method of locating a specific resource on the Internet.

Terms Related to Problem-Based Learning

Authentic assessments. Tasks with the look and feel of the real world, used to gather evidence of a student's understanding of subject matter or capability to perform a skill.

Coaching. A teaching behavior that replaces large amounts of expository presentation with facilitation, encouragement of intellectual risk taking, and frequent application of learning to real-world situations.

Content map. A graphic presentation of the subject matter and skill outcomes likely to occur from a particular PBL unit.

Debriefing. Reviewing an event or experience to gain insight into one's own effectiveness or attainment of outcomes.

Embedded instruction. Short periods of direct instruction, delivered as needed during investigations, to assist learners with new or especially difficult concepts or skills.

Ethics. A system of moral principles and good choices that people follow in their relationships with others.

Ill-structured problem. A problem with characteristics like many problems found in the real world:

- It comes with too little information, or conflicting information, to be understood when it is first encountered
- It reveals itself only through investigation
- It is likely to change as more is learned about it
- It is resistant to solution by simple formula
- It is likely to respond positively to more than one solution

Inquiry. Reasoning characterized by the iterative process of observation, hypothesizing, research and experimentation, critical thinking, and evaluation of hypotheses.

Metacognition, metacognitive. Thinking about thinking; strategies and attitudes that control the student's actions during problem solving.

Opportunity cost. In a situation involving a choice between two alternatives of almost equal value to the person faced with the choice, the alternative passed over is the opportunity cost of the alternative chosen. It represents the next alternative that would have been chosen if the actual choice had not been made. For example, you find yourself in the candy store with 50 cents in your pocket. On the shelf are chocolate squares and lemon drops, two treats that you love. Each costs 50 cents. The opportunity cost of selecting chocolate squares would be lemon drops, and vice versa. By selecting the chocolate squares, you give up the opportunity to have the lemon drops.

Problem-Based Learning (PBL). A system of curriculum organization and instructional strategies that uses ill-structured problems as the vehicles through which learners simultaneously construct new knowledge and participate in an apprenticeship in real-world problem solving.

Problem Log. A term for the activity and assessment worksheets in a PBL unit.

Solution product. A plan, invention, memo, cartoon, news article, dance routine, song lyric, impact study, and so on, that would be produced by the real-world stakeholder facing the same problem. (In this book, a product is suggested in the opening scenario for each unit.)

Stakeholder. A person who is involved in a problem. As used in Problem-Based Learning, a person who is called to action; the problem solver that the students will represent.

Bibliography

Thinking Skills

Baron, J., and R. Sternberg. 1987. *Teaching Thinking Skills: Theory and Practice.* New York: W. H. Freeman.

Beyer, B. K. 1991. *Teaching Thinking Skills: A Handbook for Secondary School Teachers.* Boston: Allyn and Bacon.

Costa, A. L., ed. 1991. *Developing Minds: A Resource Book for Teaching Thinking.* Alexandria, Va.: Association for Supervision and Curriculum Development.

Feldhusen, J. E. 1994. "Thinking Skills and Curriculum Development." *Comprehensive Curriculum for Gifted Learners,* pp. 301–24, edited by J. VanTassel-Baska. Boston: Allyn and Bacon.

Nickerson, R., K. Perkins, and E. Smith. 1985. *The Teaching of Thinking.* New York: Prentice Hall.

Paul, R., D. M. Binker, and K. Adamson. 1995. *Critical Thinking Handbook: Elementary School.* Santa Rosa, Calif.: Foundation for Critical Thinking.

Resnick, L. B. 1987. *Education and Learning to Think.* Washington, D.C.: National Academy Press.

Problem-Based Learning

Barrows, H. S. 1985. *How to Design a Problem-Based Curriculum for the Preclinical Years.* New York: Springer Publications.

_____. 1992. *The Tutorial Process.* Springfield, Ill.: Southern Illinois University School of Medicine.

Fogarty, R. 1997. *Problem-Based Learning and Other Curriculum Models for the Multiple Intelligences Classroom.* Arlington Heights, Ill.: IRI/Skylight.

Gallagher, S. A., B. T. Sher, W. J. Stepien, and D. Workman. 1995. "Integrating Problem-Based Learning into the Science Classroom." *School Science and Mathematics* 95 (3):136–46.

Johnson, T., producer. 1997. *Problem-Based Learning*. Two-tape video series. Alexandria, Va.: Association for Supervision and Curriculum Development.

Kendall, J. S., and R. J. Maranzo. 1996. *Content Knowledge: A Compendium of Standards and Benchmarks for K–12 Education*. Aurora, Colo.: Mid-Continent Regional Educational Laboratory.

Norman, G. B., and H. G. Schmidt. 1992. "The Psychological Basis of Problem-Based Learning: A Review of the Evidence." *Academic Medicine* 67 (9): 557–65.

Stepien, W. J., S. A. Gallagher, and D. Workman. 1993. "Problem-Based Learning for Traditional and Interdisciplinary Classrooms." *Journal for the Education of the Gifted* 16 (4): 338–57.

Stepien, W. J., and S. A. Gallagher. 1997. *An ASCD Professional Development Inquiry Kit: Problem-Based Learning across the Curriculum*. Alexandria, Va.: Association for Supervision and Curriculum Development.

Stepien, W. J., and S. L. Pyke. 1997. "Designing Problem-Based Units." *Journal for the Education of the Gifted* 20 (4): 87–93.

Stepien, W. J., P. Senn, and W. C. Stepien. 2000. *The Internet and Problem-Based Learning: Developing Solutions through the Web*. Tucson, Ariz.: Zephyr Press.

Alternative Assessments

Aschblacher, J. Herman, and L. Winters, 1995. *A Practical Guide to Alternative Assessments*. Alexandria, Va.: Association for Supervision and Curriculum Development.

Wiggins, G. 1996/1997. "Creating Tests Worth Taking." *Educational Leadership* 49 (8): 26–33.

Electronic Sources

Ciolek, T. M. 1999. *Ethics and Etiquette of Internet Resources*. Retrieved September 24, 1999, from the World Wide Web: http://www.ciolek.com/WWWVLPages/QltyPages/QltyEtiq.html

Harris, R. 1997. *Evaluating Internet Research Sources*. Retrieved August 4, 1999, from the World Wide Web: http://www.sccu.edu/faculty.R_Harris/evalu8it.htm

Longman Online Citation Guides. 1998. Chapter 2: "Finding Internet Sources for a Selected Discipline." Retrieved September 4, 1999, from the World Wide Web: http://longman.awl.com/englishpages/CYBER2.HTM

———. 1998. Chapter 4: "Citing Electronic Sources in APA Style." Retrieved August 4, 1999, from the World Wide Web: http://longman.awl.com/englishpages/CYBER4.HTM

Sullivan, D. 1999. *The Major Search Engines*. Retrieved September 23, 1999, from the World Wide Web: http://www.searchenginewatch.com/links/majorsearchengines/The_Major_Search_Engines/index.html

Walker, J. R. 1997. *The Columbia Guide to Online Style*. Retrieved September 24, 1999, from the World Wide Web: http://www.cas.usf.edu/english/walker/mla.html

Children's Literature Cited

Paterson, K. 1991. *Lyddie*. New York: Puffin Books.

Paulsen, G. 1996. *Hatchet*. New York: Aladdin Paperbacks.

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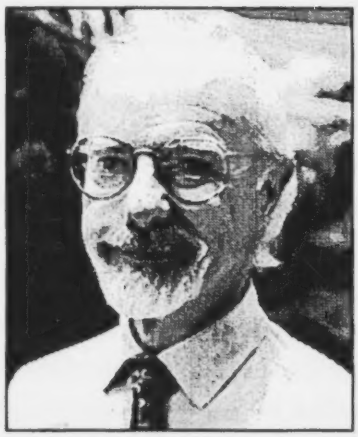

William J. Stepien taught social studies to middle- and high-school students for more than twenty years. His interest in Problem-Based Learning developed during his teaching career and is now a full-time occupation. He is the author of two books on the subject, both published by Zephyr Press. Since 1996, he has run the Consortium for Problem-Based Learning. As a private consultant, he conducts workshops with school districts around the United States. He has served as the Association for Supervision and Curriculum Development's national consultant in the field of Problem-Based Learning.

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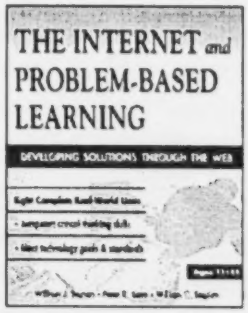

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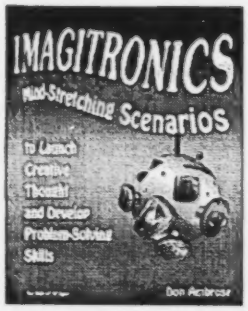

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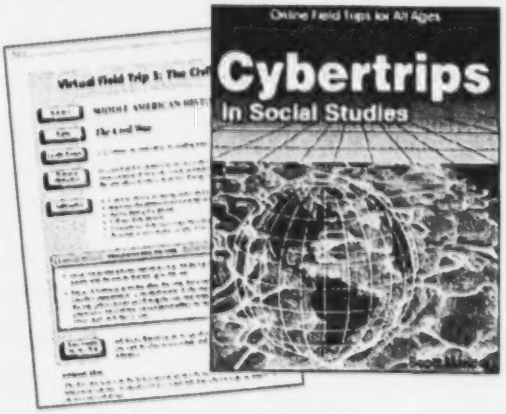

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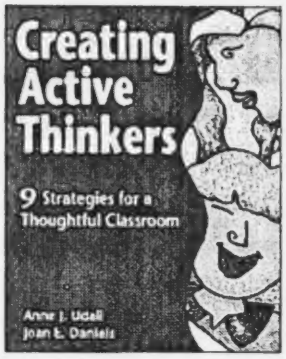

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